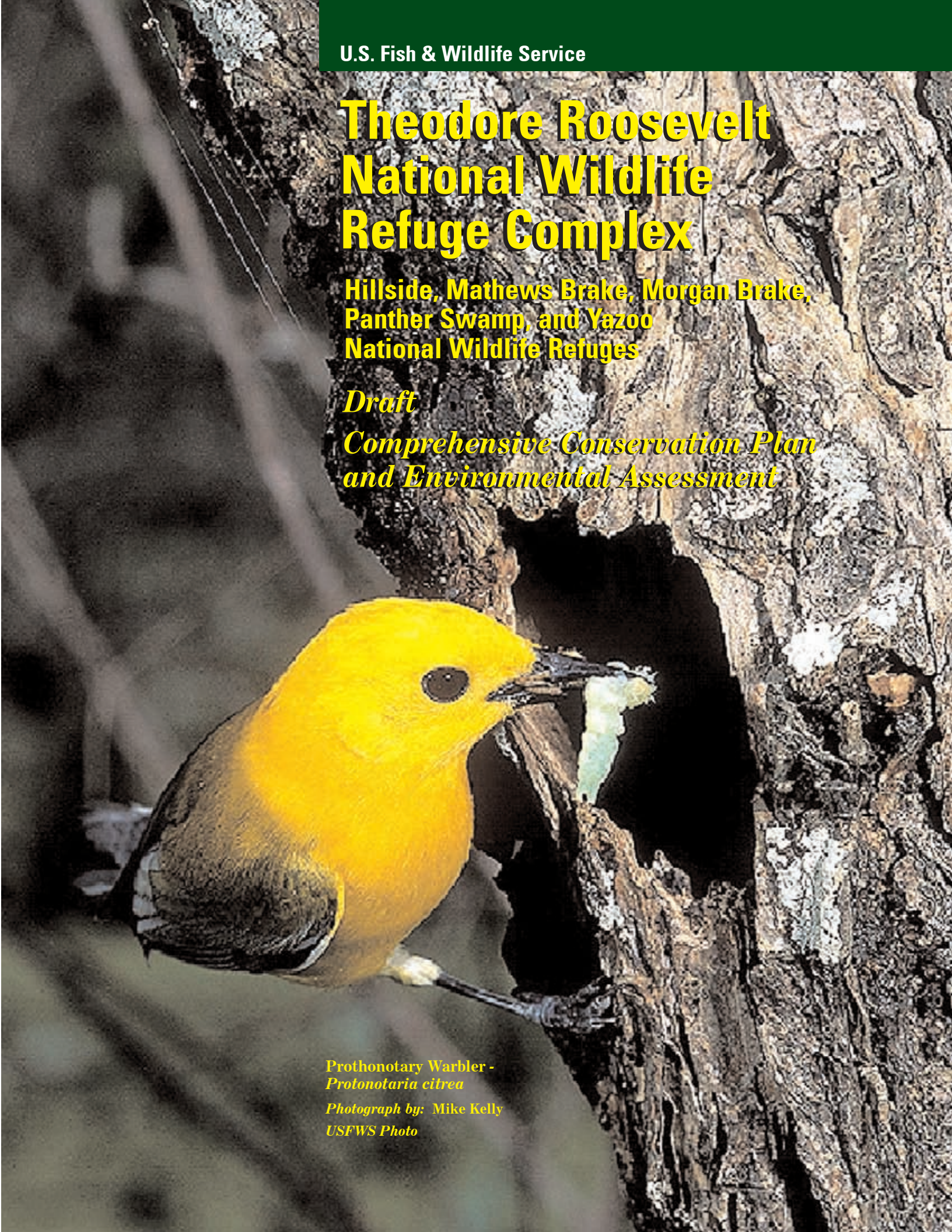
U.S. Fish & Wildlife Service

Theodore Roosevelt National Wildlife Refuge Complex

Hillside, Mathews Brake, Morgan Brake, Panther Swamp, and Yazoo National Wildlife Refuges

Draft

Comprehensive Conservation Plan and Environmental Assessment



Prothonotary Warbler - *Protonotaria citrea*

Photograph by: Mike Kelly

USFWS Photo

Comprehensive Conservation Plans provide long-term guidance for management decisions; set forth goals, objectives, and strategies needed to accomplish refuge purposes; and identify the Fish and Wildlife Service's best estimate of future needs. These plans detail program planning levels that are sometimes substantially above current budget allocations and, as such, are primarily for Service strategic planning and program prioritization purposes. The plans do not constitute a commitment for staffing increases, operational and maintenance increases, or funding for future land acquisition.

DRAFT COMPREHENSIVE CONSERVATION PLAN
AND
ENVIRONMENTAL ASSESSMENT

THEODORE ROOSEVELT
NATIONAL WILDLIFE REFUGE COMPLEX
HOLLANDALE, MISSISSIPPI

U.S. Department of the Interior
Fish and Wildlife Service
Southeast Region
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TABLE OF CONTENTS

SECTION A. DRAFT COMPREHENSIVE CONSERVATION PLAN

I. BACKGROUND 1

Introduction 1
Purpose And Need For Plan 2
Fish and Wildlife Service 2
National Wildlife Refuge System 2
Relationship To The Mississippi Department Of Wildlife, Fisheries, And Parks 4
Assistance To Private Landowners 4
Lower Mississippi River Alluvial Valley Ecosystem 6
Overview 6
Threats and Problems 6
Conservation Priorities 10

II. THE REFUGE COMPLEX 17

Introduction And History 17
Purpose And Ecosystem Context 17
Legal Policy 22
Resource And Management Descriptions 22
Physical Environment 22
Biological Environment 33
Socioeconomic Environment 35
Cultural Environment 39

III. PLAN DEVELOPMENT 43

Overview 43
Public Involvement And Planning Process 43
Issues 44
Fish and Wildlife Populations 44
Habitats 49
Visitor Services 54
Land Protection 65
General Administration 67

IV. MANAGEMENT DIRECTION 71

Introduction 71
Vision 72
Goals, Objectives, and Strategies 72
Goal 1. Habitat and Species Management 73
Goal 2. Control and Manage Invasive, Pest, and Nuisance Species 100
Goal 3. Expand research and monitoring on the complex through partnerships 102
Goal 4: Develop land protection and conservation partnerships 111
Goal 5: Cultural Resources 117
Goal 6: Provide visitor services 118
Goal 7: Administration 129

V. PLAN IMPLEMENTATION 145

Introduction 145
Proposed Projects 145
Habitat and Species Management 145
Land Protection and Conservation 152
Cultural Resources 152
Visitor Services 152
Administration 156
Funding and Personnel 157
Step Down Management Plans 159
Partnership Opportunities 159
Monitoring and Evaluation 159
Plan Review and Revision 161

SECTION B. DRAFT ENVIRONMENTAL ASSESSMENT

I. BACKGROUND 163

Purpose And Need For Action 163
Migratory Birds 163
Other Fish and Wildlife. 164
Threatened and Endangered Species 164
Habitat Management 164
Land Protection and Conservation 164
Cultural Resources. 164
Visitor Services. 164
Administration. 164
Decisions To Be Made 164
Decision Framework. 164
Planning Study Area. 164
Authority, Legal Compliance, and Compatibility. 165
Issues And Concerns 165

II. ALTERNATIVES 167

Formulation Of Alternatives 167
Migratory Birds. 167
Other Fish, Wildlife, and Plants 167
Habitats. 167
Visitor Services and Recreation. 167
Resource Threats 167
Land Protection. 167
Refuge Administration. 167
Other Human Dimensions 167
Description Of Alternatives 168
Alternative A – Current Management (No Action) 168
Alternative B - Balanced Habitat and Public Use Emphasis (Preferred Alternative) 168
Alternative C - Public Use Emphasis 170
Alternative D - Interior Forest Habitat Emphasis 170
Comparison Of Alternatives 171

III. AFFECTED ENVIRONMENT 185

IV. ENVIRONMENTAL CONSEQUENCES 187

Effects Common To All Alternatives 187
Compatible Uses. 187
Environmental Justice. 187
Co-management of Lands with U.S. Army Corps of Engineers (COE). 187
Climate Change Impacts. 188
Other Management. 188
Cultural Resources. 188
Land Acquisition. 188
Refuge Revenue-Sharing. 188
Expansion of Visitor Services. 189
Comparison Of Effects By Alternative 189
Alternative A: No Action 189
Alternative B: Balanced Habitat and Public Use Emphasis (Preferred Alternative) 190
Alternative C: Public Use Emphasis 190
Alternative D: Interior Forest Habitat Emphasis 191

V. CONSULTATION AND COORDINATION 203

SECTION C. APPENDICES

APPENDIX I. GLOSSARY 209

APPENDIX II. BIBLIOGRAPHY 227

APPENDIX III. RELEVANT LEGAL MANDATES 239

APPENDIX IV. REFUGE BIOTA 249

APPENDIX V. COMPATIBILITY DETERMINATIONS 273

APPENDIX VI. PRIORITY BIRD SPECIES AND SPECIES SUITES 295

APPENDIX VII. BUDGET REQUESTS 309

APPENDIX VIII. EXAMPLES OF PROPOSED PUBLIC USE FACILITIES AT YAZOO NWR 313

LIST OF FIGURES

Figure 1. Lower Mississippi River Alluvial Valley 8
Figure 2. Forest cover changes in the Lower Mississippi River Alluvial Valley 9
Figure 3. Migratory Bird Conservation Zone priorities 12
Figure 4. Theodore Roosevelt National Wildlife Refuge Complex. 18
Figure 5. Farm Service Agency properties managed by the Complex 19
Figure 6. Yazoo National Wildlife Refuge current managed habitats 24
Figure 7. Panther Swamp National Wildlife Refuge current managed habitats 26
Figure 8. Hillside National Wildlife Refuge current managed habitats 28
Figure 9. Morgan Brake National Wildlife Refuge current managed habitats 29
Figure 10. Mathews Brake National Wildlife Refuge current managed habitats 31
Figure 11. Yazoo National Wildlife Refuge current visitor services 55
Figure 12. Panther Swamp National Wildlife Refuge current visitor services 56
Figure 13. Hillside National Wildlife Refuge current visitor services. 57
Figure 14. Morgan Brake National Wildlife Refuge current visitor services. 58
Figure 15. Mathews Brake National Wildlife Refuge current visitor services 59
Figure 16. Conservation Partners Focus Area. 113
Figure 17. Proposed managed habitats of Hillside National Wildlife Refuge 134
Figure 18. Proposed managed habitats of Panther Swamp National Wildlife Refuge 135
Figure 19. Current and proposed managed habitats of the Panther Swamp National Wildlife Refuge Northern Unit (Carter Tract) 136
Figure 20. Proposed managed habitats of Mathews Brake National Wildlife Refuge 137
Figure 21. Proposed managed habitats of Morgan Brake National Wildlife Refuge 138
Figure 22. Proposed managed habitats of Yazoo National Wildlife Refuge 139
Figure 23. Proposed visitor services for Hillside National Wildlife Refuge 140
Figure 24. Proposed visitor services for Panther Swamp National Wildlife Refuge 141
Figure 25. Proposed visitor services for Mathews Brake National Wildlife Refuge 142
Figure 26. Proposed visitor services for Morgan Brake National Wildlife Refuge 143
Figure 27. Proposed visitor services for Hillside National Wildlife Refuge 144

LIST OF TABLES

Table 1. Acres managed by station and approved Full-time Equivalent (FTEs). 20
Table 2. Refuge establishment date, legislation, and defined purpose (excluding Holt Collier and Theodore Roosevelt NWRs). 21
Table 3. Refuge location (excluding Theodore Roosevelt and Holt Collier NWRs). 23
Table 4. Percent of land base used for agricultural production in counties surrounding Complex refuges 36
Table 5. Employment data for counties surrounding Complex refuges 36
Table 6. Demographics for Complex vicinity. 37
Table 7. Activities by participants, 16 years old and older, throughout Mississippi 39
Table 8. Estimated county tourism and recreation (T&R) revenues/employment 40
Table 9. Archaeological surveys conducted on the Complex to date 40
Table 10. Number of “hunt days” by refuge and species or group, 2004 60
Table 11. Acres managed by station, approved full-time equivalents (FTEs), and full-time positions funded by other sources. 68
Table 12. Lower Mississippi Joint Venture step-down objectives (2003) for dabbling ducks for the Theodore Roosevelt National Wildlife Refuge Complex 74
Table 13. Water control structures and wells* 76
Table 14. Reforestation shown in 10-year increments by acreage per refuge and Farm Service Agency tracts 91
Table 15. Estimated Costs to upgrade ATV Trails to “Satisfactory” Condition 124
Table 16. Additional staff needed to implement the Comprehensive Conservation Plan for the Theodore Roosevelt National Wildlife Refuge Complex 132
Table 17. Theodore Roosevelt NWR Complex Proposed Staffing Chart. 158
Table 18. Proposed schedule for Step-down Management Plans. 160
Table 19. Summary of management alternatives for the Theodore Roosevelt National Wildlife Refuge Complex 172
Table 20. Summary of environmental effects by alternative, Theodore Roosevelt National Wildlife Refuge Complex 192
Table 21. Theodore Roosevelt National Wildlife Refuge Complex planning team members 204
Table 22. Contributors to the Theodore Roosevelt National Wildlife Refuge Complex Comprehensive Conservation Plan and their area(s) of expertise. 205

I. Background

INTRODUCTION

The U.S. Fish and Wildlife Service (Service) has developed this Draft Comprehensive Conservation Plan (CCP) to provide a foundation for the management and use of refuges in the Theodore Roosevelt National Wildlife Refuge (NWR) Complex (Complex) over the next 15 years. The Complex is comprised of seven refuges: Holt Collier (2004), Hillside (1975), Mathews Brake (1980), Morgan Brake (1977), Panther Swamp (1978), Theodore Roosevelt (2004), and Yazoo National Wildlife Refuge (1936).

Prior to January 2004, the Complex was known as the Central Mississippi National Wildlife Refuge Complex. When the January 23, 2004, Theodore Roosevelt National Wildlife Refuge Act (Section 145 of PL 108-199 - the Consolidated Appropriations Act of 2004) was signed into law by President Bush, the Complex name was changed to the Theodore Roosevelt National Wildlife Refuge Complex. The Act also designated the geographically separate Bogue Phalia Unit of Yazoo NWR as the new Holt Collier NWR and directed the Secretary of the Interior to establish the 6,600-acre Theodore Roosevelt National Wildlife Refuge. The two new refuges were assembled from Farm Service Agency (formerly known as Farmers Home Administration) lands already in Service possession. Management and uses of the two new refuges (Theodore Roosevelt and Holt Collier NWRs) will be addressed in a future CCP.

This CCP was developed in compliance with the National Wildlife Refuge System Improvement Act of 1997 (1997 Refuge Act), and Part 602 of the Fish and Wildlife Service Manual. The actions described within this plan also meet the requirements of the National Environmental Policy Act of 1969. Compliance with this Act is being achieved through the involvement of the public and the inclusion of an Environmental Assessment (EA) (Section B). When fully implemented, this plan will help to achieve the vision and goals and fulfill the purposes of each refuge within the Complex.

The CCP's overriding consideration is to carry out the purposes for which each refuge was established. Fish and wildlife are the first priority in refuge management, and public use (wildlife-dependent recreation) is allowed and encouraged as long as it is compatible with the refuge's mission and purposes.

The CCP and EA were prepared by a planning team composed of representatives from various Service programs, including the National Wildlife Refuge System (Refuges, Realty, and Visitor Services), Fisheries, Ecological Services, and Migratory Birds. During CCP development the planning team incorporated the input of the Mississippi Department of Wildlife, Fisheries, and Parks; other state and federal agencies; non-governmental organizations; local citizens; and other stakeholders. This public involvement and the planning process itself are described in the Plan Development section (Chapter III).

After reviewing a wide range of public comments and management needs, the Service developed three alternatives in an attempt to determine how best to meet the goals and objectives of the Complex. The CCP represents the Service's proposed alternative and is being put forward after considering the three alternative plans, as described in the accompanying Environmental Assessment. The proposed alternative is the Service's recommended course of action for the future management of the refuges, and is embodied in this CCP.

PURPOSE AND NEED FOR PLAN

The purpose of this CCP is to identify the role that the Complex will play in support of the System's mission and to provide long-term guidance to the Complex's management programs and activities. The CCP is needed to:

- Provide a clear statement of direction for future Complex management;
- Communicate with the public and include public participation in efforts to carry out the National Wildlife Refuge System's mission;
- Provide neighbors, visitors, and government officials with an understanding of the Service's management actions on the Complex;
- Ensure that the Service's management actions, including land protection and recreational and educational programs, are consistent with the mandates of the 1997 Refuge Act;
- Ensure that the management of the Complex is coordinated with federal, state, and county plans; and
- Provide a basis for the development of budget requests for the Complex's operational, maintenance, and capital improvement needs.

Many agencies, organizations, institutions, businesses, and private citizens have developed relationships with the Service to advance the goals of the National Wildlife Refuge System. When final, this CCP will support the Partners-in-Flight Initiative, the Lower Mississippi Valley Migratory Bird Wetland Conservation Initiative, the North American Waterfowl Management Plan, the Western Hemisphere Shorebird Reserve Network, the National Woodcock Management Plan, and the National Wetlands Priority Conservation Plan.

FISH AND WILDLIFE SERVICE

"The mission of the U.S. Fish and Wildlife Service, working with others, is to conserve, protect, and enhance fish and wildlife and their habitats for the continuing benefit of the American people."

The Service manages the 96-million-acre National Wildlife Refuge System, comprised of more than 544 national wildlife refuges, thousands of small wetlands, and other special management areas. The Service also operates 66 national fish hatcheries and 78 ecological services field stations. The agency enforces federal wildlife laws, administers the Endangered Species Act, manages migratory bird populations, restores nationally significant fisheries, conserves and restores wildlife habitat such as wetlands, and helps foreign governments with their conservation efforts. The Service also oversees the Federal Aid Program and its distribution of hundreds of millions of dollars in excise taxes on fishing and hunting equipment to state fish and wildlife agencies.

NATIONAL WILDLIFE REFUGE SYSTEM

The National Wildlife Refuge System is the largest network of lands in the world specifically managed for wildlife. The mission of the Refuge System, as defined by the National Wildlife Refuge System Improvement Act of 1997, is:

"... to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife and plant resources and their habitats within the United States for the benefit of present and future generations of Americans".

The 1997 Refuge Act established, for the first time, a clear mission of wildlife conservation for the Refuge System. The Act states that each refuge shall be managed to:

- Fulfill the individual purposes of each refuge;
- Fulfill the mission of the Refuge System;
- Consider the needs of fish and wildlife first;
- Fulfill the requirement of developing a comprehensive conservation plan for each unit of the Refuge System, and fully involve the public in the preparation of these plans;
- Maintain the biological integrity, diversity, and environmental health of the Refuge System;
- Recognize that wildlife-dependent recreation activities, including hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation, are legitimate and priority public uses; and
- Retain the authority of refuge managers to determine compatible public uses.

Following passage of the 1997 Refuge Act, the Service immediately began work to carry out the new legislation, including the preparation of comprehensive conservation plans for all refuges. Consistent with the 1997 Refuge Act, all refuge CCPs are being prepared in coordination with stakeholders, including federal and state agencies, the public, non-governmental conservation organizations, and others. Each refuge is required to complete its own CCP within the 15-year schedule.

Many refuges were established to protect waterfowl-hunting opportunities, but as public interests have expanded beyond consuming wildlife to emphasize watching and photographing wildlife, the role of refuges has also evolved. Economists have reported that national wildlife refuge visitors contribute more than $400 million annually to local economies (Caudill and Henderson, Banking on Nature 2002). In a study completed in 2002 on 15 refuges in 14 states around the nation, it was shown that people visited refuges more than 35.5 million times for recreation and environmental education. Their spending generated $809.2 million of sales in regional economies. As this spending flowed through the economy, nearly 19,000 people were employed and $315.2 million in employment income was generated.

In seven years, refuge visitation has grown 36 percent. At the same time, the number of jobs generated in surrounding communities grew to 120 per refuge, up from 87 jobs in 1995, pouring more than $2.2 million into local economies. Communities near refuges also benefit economically. Expenditures on food, lodging, and transportation grew to $6.8 million per refuge, up 31% from $5.2 million in 1995. For each federal dollar spent on the Refuge System, surrounding communities benefited with $4.43 in recreation expenditures and $1.42 in job-related income (Caudill and Henderson, Banking on Nature 2002).

Volunteerism continues to be a major contributor to the successes of the Refuge System. In 2002, volunteers contributed more than 1.5 million hours of work on refuges nationwide, a service valued at more than $22 million.

The wildlife and habitat vision for the Refuge System emphasizes the following principles:

- Wildlife comes first;
- Ecosystems, biodiversity, and wilderness are vital concepts in refuge management;
- Refuges must be "healthy";
- Growth of refuges must be strategic; and
- The National Wildlife Refuge System serves as a model for habitat management with broad participation from others.

RELATIONSHIP TO THE MISSISSIPPI DEPARTMENT OF WILDLIFE, FISHERIES, AND PARKS

A provision of the 1997 Refuge Act and subsequent agency policy is that the Service shall ensure timely and effective cooperation and collaboration with other federal agencies and state fish and wildlife agencies during the course of acquiring and managing refuges. This cooperation is essential in providing the foundation for the protection and sustainability of fish and wildlife throughout the United States.

The Mississippi Department of Wildlife, Fisheries, and Parks (MDWFP) is a state-partnering agency with the Service, charged with enforcement responsibilities for migratory birds and endangered species, as well as with managing the state's natural resources. The State of Mississippi owns or manages 828,408 acres for wildlife, recreation, and fisheries, including 42 wildlife management areas (WMAs), 29 state parks encompassing 823,297 acres, and 21 lakes totaling 5,111 acres.

The MDWFP coordinates the state's wildlife conservation program and provides public recreation opportunities, including an extensive hunting and fishing program, on several WMAs and parks located near the Complex. The MDWFP's participation and contribution throughout this comprehensive conservation planning process has been invaluable. This agency continues to work with the Service to provide ongoing opportunities for open dialogue with the public on fish and wildlife issues in Mississippi. Not only has the MDWFP participated in biological reviews, public meetings, and field reviews during this process, but also the MDWFP is an active partner in annual hunt coordination planning and in various wildlife and habitat surveys. A key part of the comprehensive conservation planning process is the integration of common mission objectives between the Service and the MDWFP, where appropriate.

ASSISTANCE TO PRIVATE LANDOWNERS

Service policies for involvement with private landowners to develop and implement habitat improvement projects were generated by the 1997 Refuge Act and the Partners for Fish and Wildlife (PFW) Program. Additional authorities reside within the 1997 Refuge Act and the Fish and Wildlife Coordination Act. Section 5, Item (4) (E) of the 1997 Refuge Act specifically states that the Service shall "ensure effective coordination, interaction, and cooperation with owners of land adjoining refuges and the fish and wildlife agency of the States in which the units of the System are located".

The PFW Program Policy states that in ranking and selecting private lands projects for funding and technical assistance, the highest priority shall be placed on those projects that would provide important and direct benefits to the goals and objectives of any nearby units of the National Wildlife Refuge System, or to those projects that would improve habitat for species the Service considers to be at risk or of special concern.

Most of the land surrounding refuges in the Complex is privately owned. These privately owned lands could play an important role in the restoration and reestablishment of native habitats needed to support a diverse fish and wildlife resource historically known for this geographic area. Existing or potential habitat on private lands is important for achieving the goals and objectives of national and regional plans such as the North American Waterfowl Management Plan, Partners in Flight, Mississippi River Alluvial Valley Bird Conservation Plan, and Strategic Fisheries Plan.

The Service offers private landowners several programs that provide technical assistance and funding for priority habitat projects on private or tribal lands. The Service's primary project delivery mechanism for habitat projects on private lands currently resides within the PFW Program. Additional funding and technical assistance for private landowners are also available through several other Service funded programs, including the Mississippi Partners Program, Challenge Cost-Share Program, the Mississippi Partners for Wildlife Program, Migratory Birds Program, and several grant programs associated with threatened and endangered species.

Under the PFW Program, landowners may receive up to $25,000 for on-the-ground project implementation. Exceptions to the $25,000 limit per private landowner may be requested in unique or special circumstances. PFW projects typically receive a minimum 50 percent in-kind cost share and require a minimum 10-year commitment from the landowner. Typically, landowner agreements are for more than 20 years. Since the PFW Program was initiated in 1988, approximately 87,000 acres of bottomland hardwood forest wetlands have been planted, and over 20,000 acres of other habitat projects have been completed within the Lower Mississippi River Alluvial Valley (LMRAV). Over the past several years, the PFW Program has provided $300,000 to $400,000 in project funds each year for projects within the entire LMRAV.

The Mississippi Partners Program is funded separately from the PFW Program, receiving funding primarily through the Service's Refuge Challenge Cost-Share Program and Migratory Birds Programs. The Challenge Cost-Share Program also requires at least a 50 percent cost share from other partners. In Mississippi, this partnership involves private landowners, Ducks Unlimited, Delta Wildlife, the Mississippi Fish and Wildlife Foundation, and the MDWFP. A total of $40,000 in Service funds is made available each fiscal year through this partnership agreement with additional partner contributions reaching $200,000. These funds are used to provide water-control structures to private landowners to flood harvested cropland during the fall/winter (approximately November 15-February 28). This partnership provides significant benefits for wintering waterfowl, other migratory birds, and water quality.

The Farm Bill Conservation Programs, available through the U.S. Department of Agriculture (USDA) under the 2002 Farm Bill, provide significant opportunities for the development and implementation of habitat improvement projects on private lands. These programs include the Wetland Reserve Program (WRP), the Conservation Reserve Program (CRP), the Wildlife Habitat Incentives Program (WHIP), and the Environmental Quality Incentives Program (EQIP). Millions of dollars are available to eligible private landowners for habitat conservation under these programs. For example, under the WRP administered by the Natural Resources Conservation Service (NRCS), over 100,000 acres of permanent and 30-year easements, directed to restore natural wetlands and native vegetation, have

been implemented in Mississippi since 1990. The newly enacted Farm Bill (2002) provides authorization for over 1,000,000 additional acres at a rate of approximately 250,000 acres per year. Much of the enrolled acres for the WRP (over 45 percent) have previously come from the LMRAV. Service private lands partnerships compliment USDA conservation programs by providing supplemental funding and scientific biological technical assistance that help to support Service objectives and produce benefits for Federal trust species. All the conservation programs of the USDA Farm Bill have specific eligibility and other important project selection criteria. This information is readily available through the Internet or from USDA, and Service biologists assigned to work with private landowners are very knowledgeable of these programs.

LOWER MISSISSIPPI RIVER ALLUVIAL VALLEY ECOSYSTEM

OVERVIEW

Refuges in the Theodore Roosevelt National Wildlife Complex are located within a physiographic region known as the Lower Mississippi River Alluvial Valley (LMRAV) (Figure 1). Historically the LMRAV was a 25-million-acre complex of forested wetlands that extended along both sides of the Mississippi River from Illinois to Louisiana. The extent and duration of seasonal flooding from the Mississippi River fluctuated annually, recharging the LMRAV's aquatic systems and creating a diversity of dynamic habitats that supported a vast array of fish and wildlife resources.

THREATS AND PROBLEMS

Forest Loss and Fragmentation

The LMRAV has changed markedly over the last 100 years as civilization spread throughout the area. Since European settlement, it has been estimated that 20 million acres of bottomland forested wetlands have been lost (USFWS 1999) (Figure 2). The greatest changes to the landscape have been land clearing for agriculture and flood control projects. Although these habitat alterations have allowed people to settle and earn a living in the area, they have had a negative effect on biological diversity and integrity and the environmental health of the LMRAV. Immense areas of bottomland hardwoods have been reduced to forest fragments, ranging in size from very small tracts of limited functional value to a few large areas that have retained many of the original functions and values of bottomland hardwood forest. Species endemic to the LMRAV that have become either extinct, endangered, or threatened include the red wolf, Florida panther, Louisiana black bear, Bachman's warbler, Carolina parakeet, ivory-billed woodpecker, and Bachman's sparrow.

Breeding bird surveys show continuing declines in species and populations. The avian species most adversely affected by fragmentation are species that depend on large contiguous blocks of hardwood forest, forest interiors, or good water quality, and species that have special habitat requirements such as mature forests or a particular food source.

More than 70 species of breeding neotropical migratory birds are found in the region. Some of these species, including Swainson's warbler, prothonotary warbler, swallow-tailed kite, wood thrush, and cerulean warbler, have declined significantly and need large forested blocks to recover and to sustain their existence.

The fragmentation of bottomland hardwoods has produced forested islands of habitat in a sea of agricultural lands. Intensive agriculture has removed most of the forested corridors along sloughs that formerly connected forest patches. The loss of connectivity between the remaining forested tracts hinders the movement of wildlife between tracts, reduces the functional values of many remaining smaller forest tracts, and results in a loss of gene flow. For some wide-ranging species, restoring connections between habitats and reestablishing travel corridors is particularly important.

Alterations to Hydrology

In addition to the loss of the majority of bottomland forested wetlands, there have been significant alterations in the region's hydrology due to urban development, river channel modification, flood control levees, reservoirs, and deforestation. There has also been degradation to aquatic systems from excessive sedimentation and contaminants.

Figure 1. Lower Mississippi River Alluvial Valley
(2004TRNWRmd)

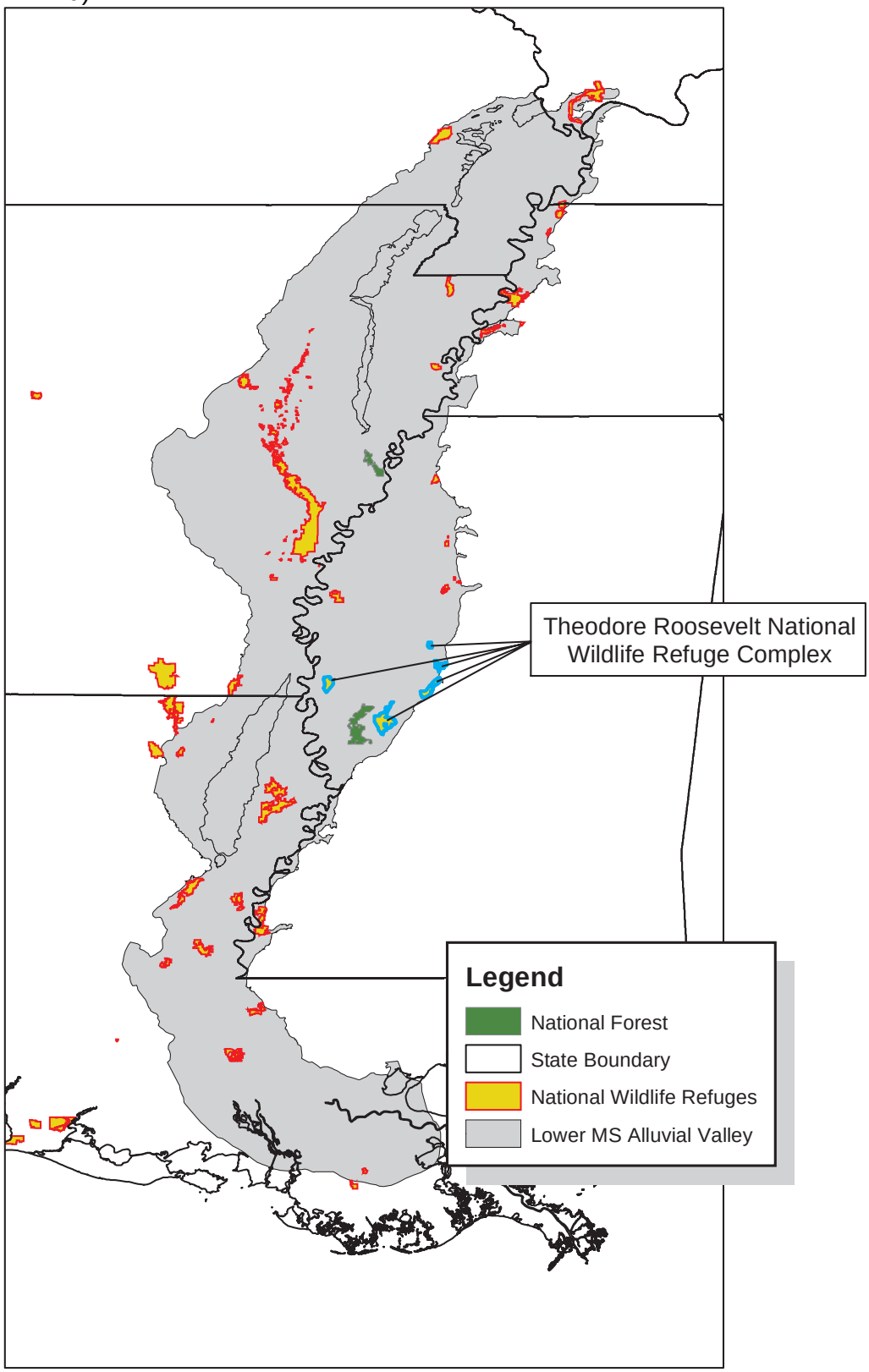
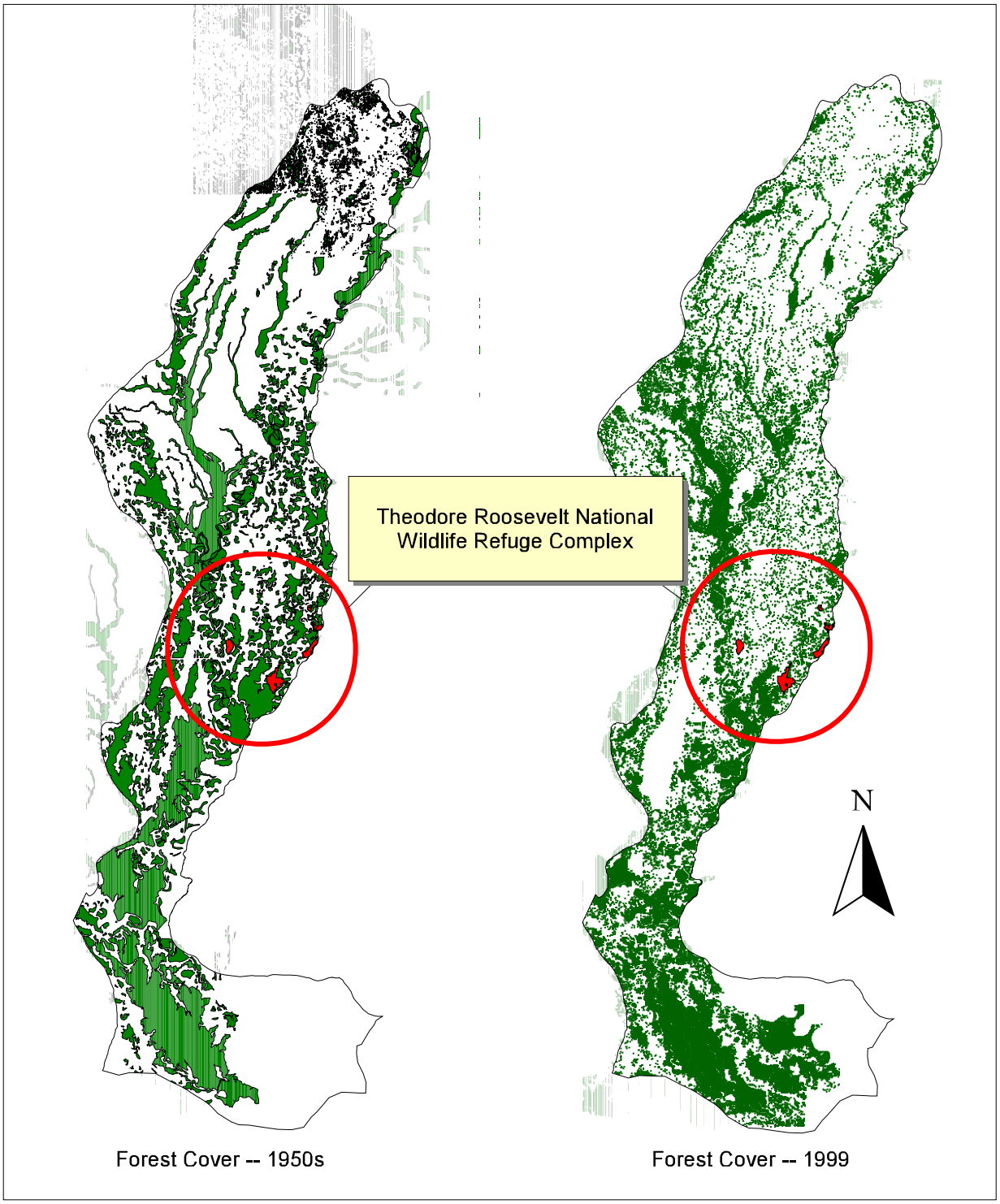


Figure 2. Forest cover changes in the Lower Mississippi River Alluvial Valley
(2004trnwrmdforestcover)



The natural hydrology of a region directly impacts the connectedness of forested wetlands and is indirectly responsible for the complexity and diversity of habitats through its effects on topography and soils. Natural resource managers recognize the importance of dynamic hydrology to forested wetlands and waterfowl-habitat relationships (Fredrickson and Heitmeyer 1988).

In the LMRAV large-scale, man-made hydrological alterations (involving channelizations, flood control, and navigation projects) have produced widespread changes in the spatial and temporal patterns of flooding. The alterations have reduced both the extent and duration of the annual seasonal flooding, significantly affecting the forested wetlands and their associated wetland-dependent species. Since wetland ecosystems depend on a dynamic interface of hydrologic regimes to maintain water, vegetation, and animal complexes and processes, the LMRAV's historic functions and values cannot be restored in their entirety (Mitsch and Gosselink 1993).

Siltation of Aquatic Ecosystems

Land clearing and hydrologic alterations have led to an accelerated accumulation of sediments and contaminants in all aquatic ecosystems in the LMRAV, including wetlands, lakes, rivers, sloughs, and bayous. Many aquatic areas have filled up with sediments, reducing both depth and surface area. Concurrently, non-point source runoff of silt, excess nutrients, and chemicals threaten the area's remaining aquatic resources.

Hydrologic alterations have also ceased the natural processes that historically created oxbow lakes, sloughs, and river meander scars.

Proliferation of Invasive Aquatic Plants and Animals

The degradation of the LMRAV's aquatic ecosystems is compounded by growing threats from invasive aquatic vegetation. Static water levels caused by the lack of annual flooding and reduced water depths resulting from excessive sedimentation have created conditions favorable for the establishment and proliferation of several species of invasive aquatic plants, such as alligator weed (*Alternanthera philoxeroides*) and coontail (*Ceratophyllum demersum*). The introduction of exotic (non-native) vegetation, such as soda apple (Solanum viarum), Old World climbing fern (*Lygodium microphyllum*), and others, which are capable of out-competing native species and of aggressive growth, is further threatening the health and viability of aquatic systems. The overgrowth of invasive aquatic species reduces open water areas, adversely affects fish and other aquatic species, and can prevent boat access and other recreational use. Non-native wildlife and fish have also been successfully introduced or released in this temperate climate, often out-competing native wildlife for limited resources.

CONSERVATION PRIORITIES

Declines in the LMRAV's bottomland hardwood forests and their associated fish and wildlife resources have prompted the Service to designate the bottomland forest system as an ecosystem of special concern. A collaborative effort involving private, state, and federal conservation partners is underway to restore some forested wetlands in the LMRAV by prioritizing areas for reforestation and by managing remaining forested wetlands to most effectively maintain and restore biological diversity. However, most of the 25+ million acres of forested wetlands that have been cleared and converted to other uses in the LMRAV will not be reforested. Some areas have been identified for intensive management for non-forest-dependent species, such as waterfowl and shorebirds. Through coordinating cooperative efforts, apportioning resources, and focusing of available programs, the LMRAV's biological diversity can be improved.

Several coordinated efforts have been initiated to set priorities and establish focus areas to overcome the impacts of hydrologic changes and forest fragmentation. A cooperative private-state-federal partnership known as the North American Waterfowl Management Plan, Lower Mississippi Valley Joint Venture (LMVJV), was established in 1986 to help provide sufficient wintering waterfowl habitat throughout the LMRAV. Partners operating in the LMVJV have helped to establish step-down management objectives (expressed in duck-use-days and number of acres of flooded habitat) for public and private lands throughout the LMRAV.

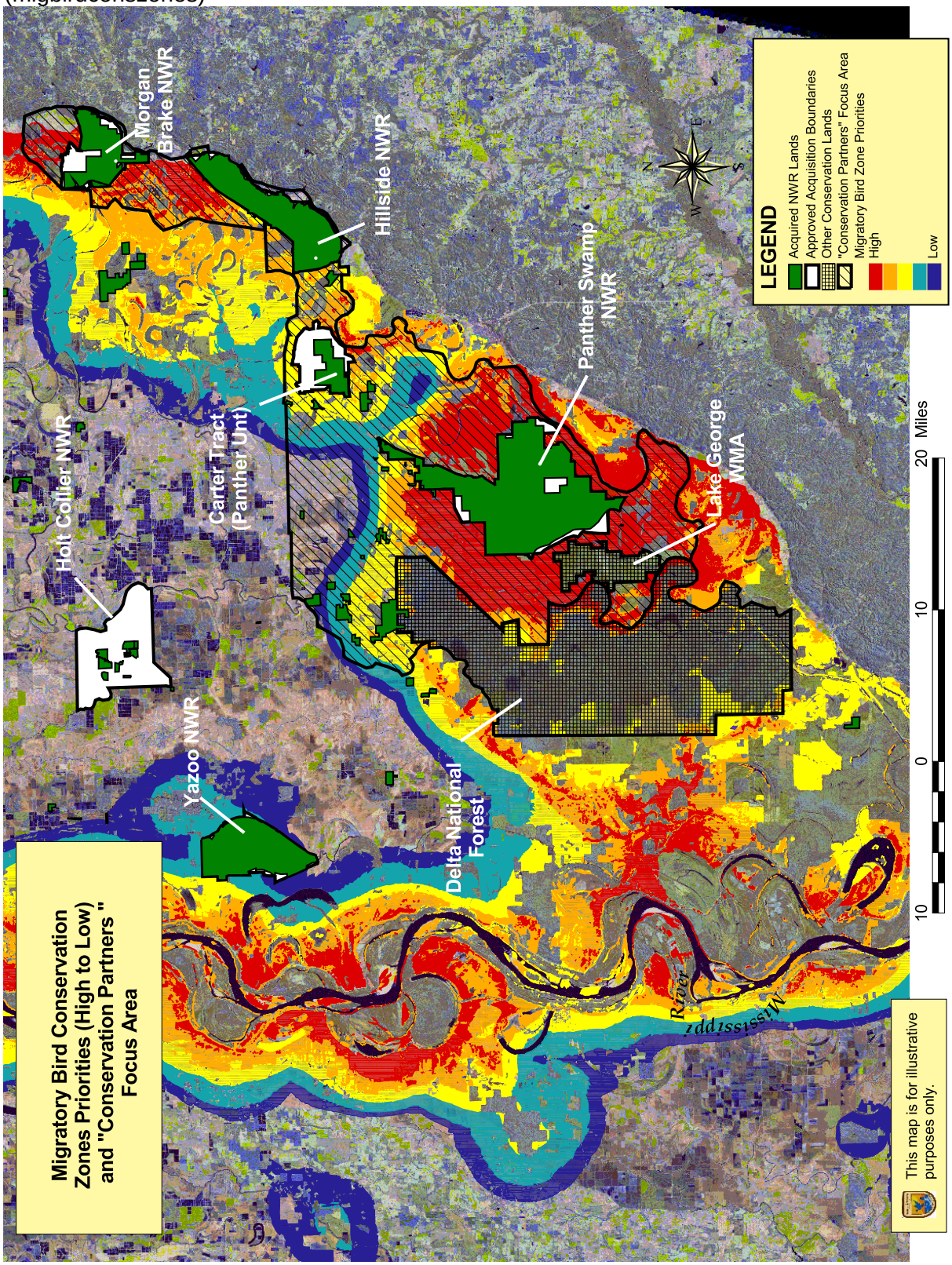
The initial LMVJV effort for waterfowl was expanded to include population objectives for shorebirds and neotropical forest-nesting birds. The LMVJV is working with the U.S. Shorebird Conservation Working Group to establish step-down objectives for shorebird foraging habitat for the fall migration period throughout the LMRAV.

Another cooperative private-state-federal partnership involving the North American Waterfowl Management Plan, Partners-in-Flight, and the LMVJV has identified a number of Migratory Bird Conservation Zones (MBCZs) (Figure 3). Refuges in the Complex are identified in these zones as core areas. The purpose of identifying these zones is to focus a number of private, state, and federal restoration programs into specific areas in an effort to provide maximum program benefits for neotropical forest interior-nesting birds. The goal is to provide larger islands or blocks of forested habitat in an otherwise highly fragmented landscape. The targeted block sizes range from 10,000 to 100,000 acres. Such areas are large enough to support viable populations of various suites of neotropical songbirds and other species (such as the Louisiana black bear) that require large forested blocks.

Most MBCZs encompass an existing or proposed wildlife management area or national wildlife refuge. Public lands serve as anchors of biodiversity that are enhanced and supported by the expansion of forested blocks, either through public or private management.

One of the principal challenges to the restoration efforts underway in the LMRAV, and one that affects refuges in particular, is the need to meet long-term management objectives that address comprehensive ecosystem needs, including those of wintering waterfowl, neotropical birds, shorebirds, wading birds, bears, and other wide-ranging species. Management for one species or species group can conflict with management objectives for another species or species group. The tendency is to pursue short-term priorities that frequently change as scientific knowledge expands and interests in special resources shift. Caution must be exercised to prevent the initiation of restoration actions that are difficult to reverse and fail to meet the long-term, comprehensive management needs of the ecosystem or of a specific area within the ecosystem. For example, a goal to reforest all of Yazoo NWR in an effort to reduce fragmentation and create a 10,000 acre forest block to meet an objective for forest interior-nesting birds would overlook the critical habitat needs of waterfowl and shorebirds, which require a mosaic of seasonally flooded croplands, moist soil areas, and forested wetlands.

Figure 3. Migratory Bird Conservation Zone priorities
(migbirdconszones)



The habitat goals of the LMVJV can only be met through the active management of croplands, moist-soil areas, and forested wetlands on both public and private land (Reinecke and Baxter 1996). Active management (i.e., vegetation manipulation and hydrology restoration) is required to compensate for the spatial and temporal habitat changes that have been caused by deforestation and hydrologic alterations throughout the LMRAV. The Complex uses a system of levees, water control structures, and wells to provide dependable seasonally flooded croplands and moist-soil areas as part of its waterfowl and shorebird habitat step-down objectives. If totally reforested, the Complex would not be able to meet its waterfowl/shorebird habitat step-down objectives. Setting habitat and species objectives from the perspective of the LMRAV enables managers to plan and provide habitat for a diversity of species throughout their ranges.

Although reforestation is probably the best solution for restoring the forests that have been converted to row-crop agriculture, flooding drives the ecological system in the LMRAV, and the plant and animal communities throughout the LMRAV are dependent upon the hydrologic cycle. Therefore, to meet waterfowl and shorebird habitat objectives, land managers must manage water and mimic the flood cycles that historically characterized the LMRAV.

Complex Recreational Use

The Complex contains large populations of fish and wildlife, including a number of game species. The primary recreational activities are public hunting, fishing, and wildlife observation. Public use activities on these refuges are provided in accordance with federal, state, and refuge regulations.

Deer hunting is the most popular public use activity on refuges in the Complex, followed by duck hunting and then fishing. Hunting programs also offer opportunities to take dove, rabbits, squirrels, raccoons, other fur bearers, turkey, and feral swine. Large portions of some of the refuges are accessible by all-terrain vehicles (ATVs) on designated trails. The use of ATVs is allowed only for hunting and fishing purposes. There are numerous lakes and streams suitable for fishing, and boat ramps are available on Panther Swamp and Mathews Brake NWRs. On Yazoo NWR pesticide levels in fish prohibit fishing.

Wildlife observation is increasing in popularity as infrastructure is developed for viewing opportunities. Two observation platforms were completed on Yazoo NWR in 2003: the Holt Collier Boardwalk Trail and Tower and the Alligator Pond Wildlife Viewing Platform. Additional public use recreation activities are planned, particularly on Yazoo and Morgan Brake NWRs, where access to natural areas is not restricted by annual seasonal flooding.

Yazoo Backwater Area

Refuges in the Complex are all located within the physiographic region known as the Yazoo Backwater Area (YBWA). Land-use trends within the YBWA have generally paralleled those of the LMRAV as a whole. Early settlements were typically restricted to natural levees associated with the Mississippi River and its primary meander belts. Because natural levees were the best drained and least flood-prone, settlers initially inhabited those lands. Forested lands at the highest elevations were cleared to produce food crops and silage for local consumption, and logging became an economic mainstay of the time.

As settlement progressed, small-scale, local drainage and flood control projects were initiated. Simultaneously, federal navigation improvements were constructed on the Mississippi River and on numerous tributaries. As a result of those early infrastructure improvements, additional forested acreage was cleared to produce cotton and other commodity crops for export, rather than local consumption. However, up through the 1920s, agricultural expansion beyond the natural levees and terraces was limited by the direct effects of flooding, lack of drainage, and relatively poor production techniques. With the advent of federal flood control and drainage in 1928, coupled with post-depression expansion of the national economy and increased mechanization, the stage was set for agricultural encroachment into the more poorly drained, frequently flooded portions of the LMRAV. At that point in time (the early 1950s), agriculture was generally restricted to the higher, better-drained soil associations. As a matter of record, the YBWA has historically served as a storage area for flood waters from the Mississippi River and for runoff from the upper Yazoo Delta.

The 1950s ushered in an era of major agricultural expansion into the poorly drained, frequently flooded portions of the LMRAV. Fueled by expanding world markets, inflating land prices, and federal flood control projects, agricultural expansion continued into the 1970s under highly favorable economic conditions with a 20-year period in which major floods were lacking on the Mississippi River. From 1947 to 1977, more than 3.5 million acres of forested wetlands were converted to agriculture in Arkansas, Louisiana, and Mississippi (USFWS 1999). Forested wetlands totaling 317,155 acres within a 6-county area (Sharkey, Issaquena, Humphreys, Yazoo, Washington, and Warren) were converted to agriculture between 1957 and 1977 (MacDonald et al., 1979). By the late 1970s, however, that era of agricultural expansion had run its course in the YBWA.

The late 1970s and the decade of the 1980s were a period of stable land use, but turbulent economic conditions within the agricultural community in the YBWA (and the LMRAV as a whole). The 1973 flood, which inundated nearly 15 million acres of the LMRAV, including about 640,000 acres of the YBWA, broke the 20-year dry spell, and a period of normal to above-normal rainfall produced significant flooding within the YBWA in 1974, 1975, 1979, 1982, 1983, and 1989. The implications of farming high-risk areas came to the forefront at a time when the condition of the agricultural economy was essentially the reverse of the expansion years. Delinquent loans and foreclosures became commonplace in the 1980s. The Federal Land Bank, the Farmers Home Administration, insurance companies, and other private lending institutions became major landowners, holding an inventory most often represented by cleared wetlands.

The combination of economic and hydrologic conditions that made marginal yields on high-risk lands profitable proved to be temporary and transient. Land use and land capability had become substantially misaligned, and “land that should never have been cleared” became part of the lexicon of the agricultural community. Thirty years of agricultural expansion left a landscape that failed to meet the tests of either economic or ecological sustainability.

As the farm crisis in the early 1980s brought an almost immediate end to the long-standing trend of agricultural expansion into wetlands, the socio-political and socio-economic forces that had driven that trend also began to change. Passage of the 1985 Food Security Act (or Farm Bill) marked a public recognition that factors underlying historic land-use trends, which had previously been treated as almost mutually exclusive should be addressed in the context of their interdependency. Federal programs and policies to remove marginal agricultural lands from production, reduce damage-susceptible floodplain development and associated flood disaster payments, protect and restore wetlands, and provide for sustainable ecological and economic development have steadily advanced since then. These programs were given additional impetus by the 1993 flood (and subsequent post-flood evaluations) on the upper Mississippi River.

During the 1980s, land use remained relatively constant. However, between 1990 and 1998, the historic wetland decline in the YBWA was replaced by a new land-use trend. More than 40,700 acres of cleared agricultural lands were restored to wetland conservation uses, and an additional 16,664 acres of forested lands were protected during that 8-year period (Pers. comm., C. Baxter 2000).

II. The Refuge Complex

INTRODUCTION AND HISTORY

Refuges in the LMRAV provide important habitat for resting, feeding, and breeding needs for waterfowl, other birds, and resident wildlife. Refuges in the Complex were primarily established to provide and maintain habitat for wintering waterfowl and other migratory birds traveling throughout the Mississippi Flyway. The Complex is comprised of seven refuges, with a Complex headquarters located at the Yazoo NWR near Hollandale, Mississippi (Figure 4). This CCP covers five of the seven refuges: Hillside, Mathews Brake, Morgan Brake, Panther Swamp, and Yazoo NWRs. Refuge offices are also located at Morgan Brake NWR and Panther Swamp NWRs. The refuge staff located at the Morgan Brake NWR Office manages Morgan Brake, Hillside, and Mathews Brake NWRs. The refuge staff located at Panther Swamp NWR manages Panther Swamp NWR and the Hillside NWR expansion area known as the Carter Tract. In addition, the Complex manages over 12,000 acres of Farm Service Agency fee title tracts in several counties (Figure 5).

The Complex includes 18 positions: 16 approved full-time permanent budgeted positions (Table 1) and two full-time permanent positions that are funded by U.S. Army Corps of Engineers' funding and hunt program permit fees. Two "floating" equipment operator positions are shared among all the refuges in the Complex. Both employees report to Yazoo NWR, travelling to the remaining refuges as needed to support maintenance, projects, law enforcement, and other needs. Between two and four temporary seasonal positions provide additional support each year when it is most needed during the hunting season, and for maintenance, habitat management, and administrative tasks. Each spring a volunteer is recruited from the Student Conservation Association to work for 17 weeks to assist with the Yazoo NWR wood duck nest box program and other biological tasks. Each summer for two months, the Youth Conservation Corps provides 6-9 youths to mow grass, trim trees, paint, perform facility maintenance, and conduct other tasks on Yazoo, Morgan Brake, and Panther Swamp NWRs. A new Friends Group, the Theodore Roosevelt Society, was established in June 2004, and efforts are currently underway to recruit members.

PURPOSE AND ECOSYSTEM CONTEXT

Although the Complex has an overriding purpose of providing for the habitat needs of migratory birds, with an emphasis on waterfowl, each refuge within the Complex has a unique purpose and establishing legislation (Table 2). The plan identifies specific goals, objectives, and strategies that are intended to support these individual refuge purposes. Management for the entire Complex of lands is combined due to the refuges' proximity, their similarity of issues and habitats, and the added value of managing refuges cooperatively as a network of habitats within the Lower Mississippi River Ecosystem.

The North American Waterfowl Management Plan's Lower Mississippi Valley Joint Venture office, working through a collaborative effort with private, state, and federal agencies, has established certain habitat objectives for the LMRAV. These objectives have been stepped down for private and public lands throughout the LMRAV. The step-down objectives for the Complex are to provide a minimum of 8,287 acres of managed water, including 4,505 acres of flooded moist-soil plants, 2,760 acres of flooded timber, and 1,022 acres of unharvested crops. Managed water is defined as areas that can be flooded through management actions taken by refuge staff, such as the pumping of water and the closing of gates on water control structures. The Complex also has an objective from the Joint Venture to provide 300 acres of shorebird habitat during the annual fall migration period from July 15 through October 15.

Figure 4. Theodore Roosevelt National Wildlife Refuge Complex.

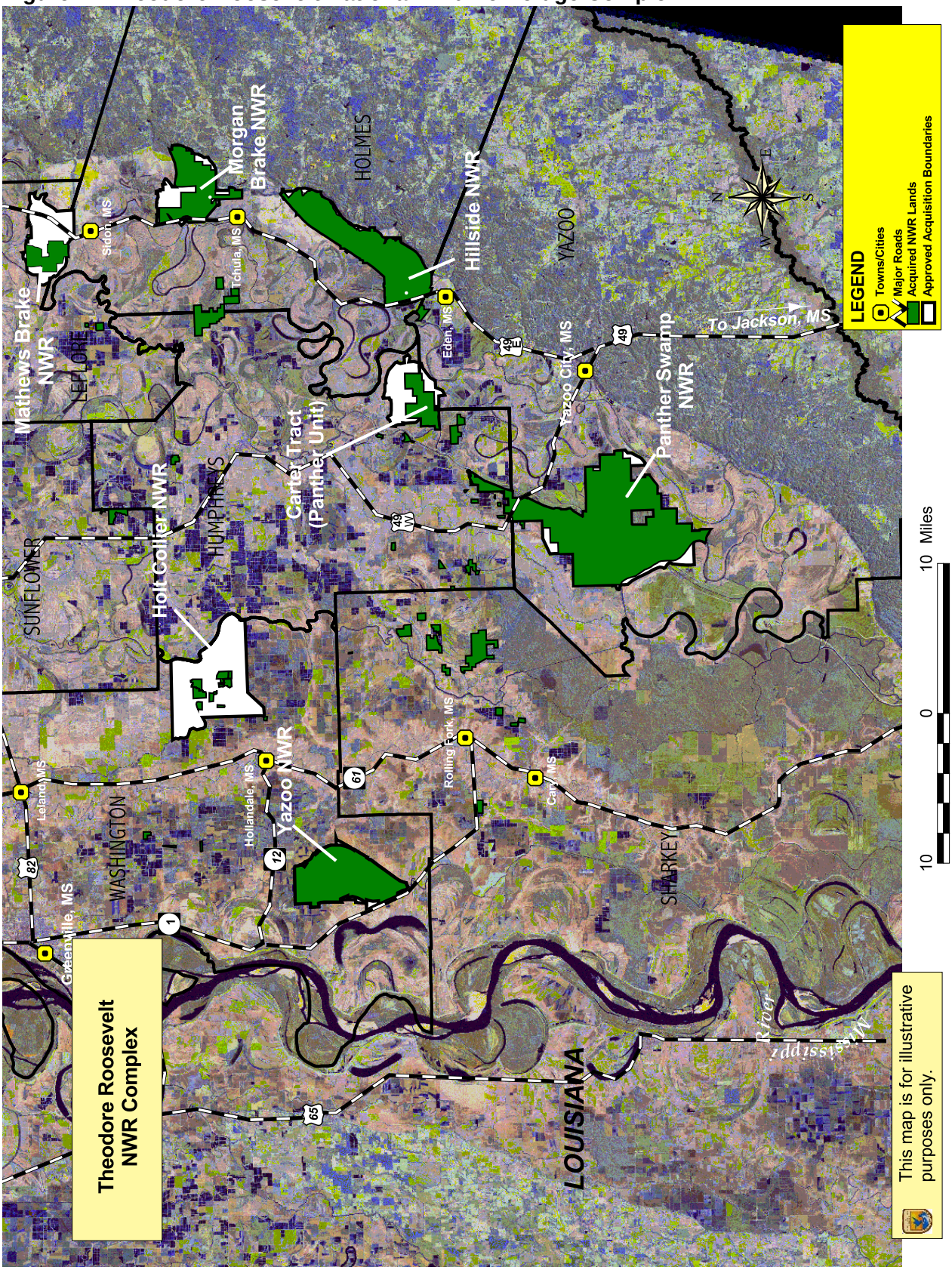


Figure 5. Farm Service Agency properties managed by the Complex

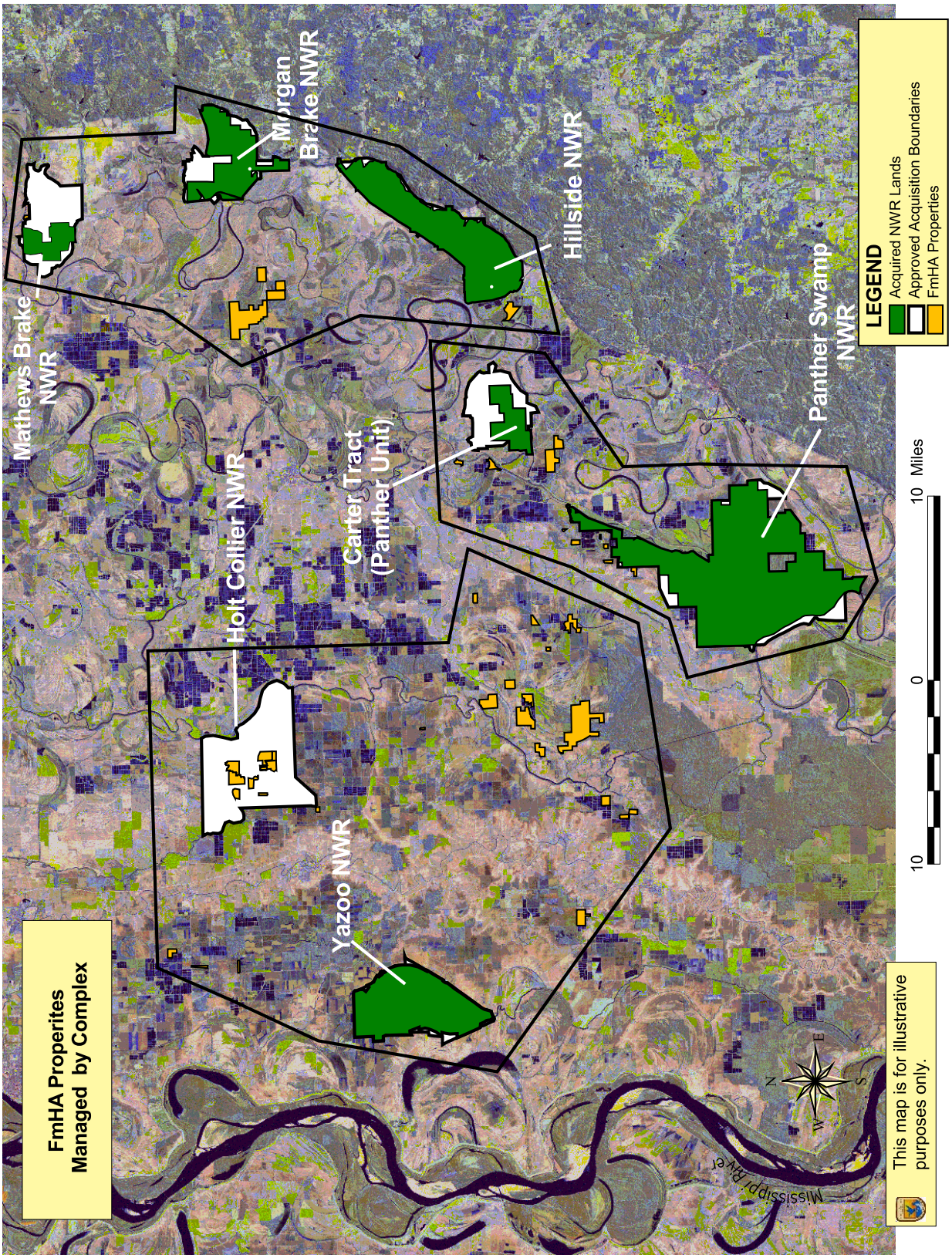


Table 1. Acres managed by station and approved Full-time Equivalent (FTEs).
Note: Two FTEs for equipment operators and one position for a Tractor Operator are shared by all refuges in the Complex. Two positions (Tractor Operator, GS-6 and Office Clerk, GS-5) are funded by the U.S. Army Corps of Engineers and hunt program permit fees.

Refuge Office	Refuge(s) Managed	Acres Managed	Complex/Refuge Staff
Complex Headquarters (located at Yazoo NWR)	Hillside Holt Collier Mathews Brake Morgan Brake Panther Swamp Theodore Roosevelt Yazoo	77,090 acres of refuge lands inside acquisition boundaries. 12,291 acres in (43) Farm Service Agency Fee Title 998 acres in (12) Farm Service Agency easement 80 acres in (1) MDOT Transfer (included in Carter Tract) 80 acres in (1) Fee Title (Theunissen) Darlove Tract Total 90,459 acres	Project Leader (GS-14) Deputy Project Leader (GS-13) Forester (GS-12) Park Ranger (LE) (GS-9) Private Lands Biologist (GS-11) Wildlife Biologist (GS-11) Administrative Officer (GS-9) Tractor Operator (WG-6)* (Shared) Office Clerk (GS-5)**
Yazoo NWR	Yazoo	13,022 acres	Automotive Worker (WG-8) Equipment Operator (WG-9) (Shared)
Morgan Brake NWR	Hillside, Mathews Brake, and Morgan Brake	25,371 acres	Refuge Manager (GS-11) Biological Technician (GS-7) Park Ranger (Interpretive)(GS-7) Equipment Operator (WG-8)++ (Shared)
Panther Swamp NWR	Panther Swamp	38,697 acres	Refuge Manager (GS-11) Park Ranger (Interpretive) (GS-7) Equipment Operator (WG-10)
TOTAL Complex Staff			**18**

*Funded by Corps of Engineers funds
**Funded by Hunt Permit Fees
++FTE for a WG-8 Equipment Operator position is currently stationed at Yazoo NWR.

Table 2. Refuge establishment date, legislation, and defined purpose (excluding Holt Collier and Theodore Roosevelt NWRs).

Refuge	Year Established	Establishing Legislation	Refuge Purpose
Yazoo	1936	Migratory Bird Conservation Act (1929), Migratory Bird Treaty Act (1918)	"...for use as an inviolate sanctuary, or for any other management purposes, for migratory birds..."
Hillside	1975	Fish and Wildlife Coordination Act	"...shall be administered by him (Secretary of Interior) directly or in accordance with cooperative agreements...and in accordance with such rules and regulations for the conservation, maintenance, and management of wildlife resources thereof, and its habitat thereon..."
Panther Swamp	1978	Migratory Bird Conservation Act (1929), Refuge Recreation Act (1962)	"...for use as an inviolate sanctuary, or for any other management purposes, for migratory birds..." "...suitable for (1) incidental fish and wildlife-oriented recreation development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species..."
Mathews Brake	1980	Migratory Bird Conservation Act (1929)	"...to contribute to perpetuation of the migratory waterfowl resource in the lower Mississippi River Delta..."
Morgan Brake	1977	Migratory Bird Conservation Act (1929) Fish and Wildlife Coordination Act	"...to contribute to perpetuation of the migratory waterfowl resource in the lower Mississippi River Delta..." "...shall be administered by him (Secretary of Interior) directly or in accordance with cooperative agreements...and in accordance with such rules and regulations for the conservation, maintenance, and management of wildlife resources thereof, and its habitat thereon..."

z

A core forest area is currently defined as a contiguous block of forest that is 1.6 miles from the forest edge (LMVJV 2001). This protective core forest habitat is essential to many of the highest priority bird species, such as the cerulean warbler and swallow-tail kite. There are interior forest objectives for each of the refuges within the Complex, supporting the Partners-in-Flight Plan. A 100,000-acre forest objective was established in the area around Panther Swamp, linking it with Delta National Forest (>60,000 acres) and Lake George Wildlife Management Area (>8,000 acres). A 10,000-acre interior forest habitat objective was identified for Yazoo NWR, linking and reforesting the areas around it and Leroy Percy State Park. In addition, each of the remaining refuges has a 10,000-acre objective, to be met by reforesting lands within current acquisition boundaries and by working with adjacent private landowners interested in reforestation projects, which would link forested habitats. Waterways and wetlands within forest blocks are included in the proposed acreage. These minimum objectives would establish two core forested areas of 80,000 and 8,000 acres.

One species of concern, the woodcock, is showing significant long-term declines in the eastern United States. Habitat loss, including the loss of preferred, safe, nocturnal wintering habitats, is likely a key factor. The Complex may be important in helping the Service to meet its objectives in the North American and Regional Woodcock Management Plans.

LEGAL POLICY

Refuge management, development, and administration are guided by a variety of international treaties, federal laws, and executive orders. Management options under each refuge's establishing authority and the National Wildlife Refuge System Improvement Act of 1997 (the legal and policy guidance for the operation of national wildlife refuges) are contained in the documents and acts listed in Appendix III.

RESOURCE AND MANAGEMENT DESCRIPTIONS

PHYSICAL ENVIRONMENT

Climate

The area climate is a humid, warm-temperate, continental type characteristic of the southern United States. The average yearly rainfall is 52.48 inches, with March being the wettest month (averaging 5.62 inches) and August being the driest (2.37 inches.) Tropical storms or hurricanes originating from the Gulf of Mexico may occasionally bring several days of heavy rain. Thunderstorms, which usually bring the heaviest rains, are only occasionally accompanied by hail and tornados. Drought conditions during the summer may increase the danger of fire. Average yearly snowfall is less than an inch.

January is generally the coldest month, while July is the hottest. Winters are mild, with temperatures seldom remaining below freezing for more than 24 hours. Summers are hot and humid with heat indexes commonly reaching 110-115°F. The average growing season is 219 days from March 25 to October 30.

Physiography and Geography

The "Mississippi Delta" (Delta) is an alluvial plain created by meanderings of the Mississippi River. The Delta extends from Memphis, Tennessee to Vicksburg, Mississippi, and is 75 miles wide at the widest point, tapering on each end. The Mississippi River flows along the Delta's western edge, while the eastern edge is bordered by steep bluffs that rise 300 feet above the elevation of the Delta. The Delta is composed of alluvial soils deposited primarily by the Mississippi River, with surface features

resulting from the meandering of the Mississippi River and lesser streams such as the Yazoo River. The Delta has a slight downward slope to the east as a result of natural levee formation. This slope causes most of the drainage to be away from the Mississippi River, eventually flowing into the Yazoo River before joining the Mississippi River at the lower extremity of the Delta. Old channels, oxbow lakes, brakes, sloughs, and other features developed in areas that bordered the main river channels, while low-lying slackwater areas separated from currents and the channel resulted in broad flats. These features intermixed as the Mississippi River meandered across the Delta.

Table 3. Refuge location (excluding Theodore Roosevelt and Holt Collier NWRs).

Refuge	County	Location
Hillside	Holmes and Yazoo	13 miles north of Yazoo City, Mississippi and 3.5 miles east of Thornton
Mathews Brake	Leflore and Holmes	9 miles south of Greenwood and 5 miles west of Sidon, Mississippi, between Highway 49 and Highway 7
Morgan Brake	Holmes	2 miles north of Tchula, turn right on Providence Road. The refuge lies between U.S. Highway 49 and the adjacent loess hills north of Tchula
Panther Swamp	Yazoo and Humphreys	4 miles east of Holly Bluff and four miles west of Yazoo City
Yazoo	Washington	28 miles south of Greenville, lying between Highways 1 and 61

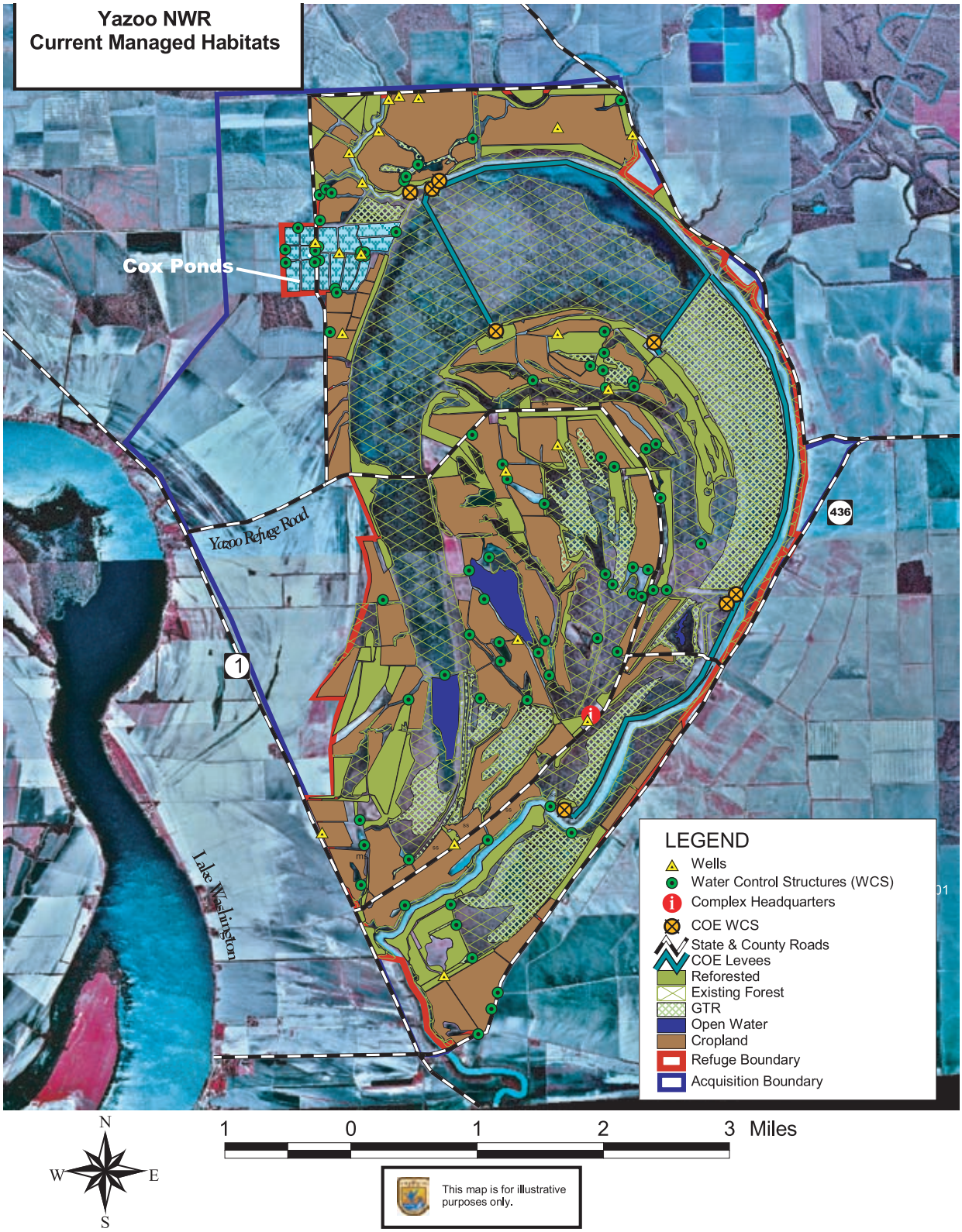
Yazoo National Wildlife Refuge

Yazoo NWR encompasses 13,706 acres and is located 4 miles east of the Mississippi River in Washington County. Elevations vary 23 feet, from 90 feet mean sea level (MSL) in Steele Bayou to 113 feet MSL at the Headquarters Office. The primary habitat feature is Swan Lake, a 3,600-4,000-acre oxbow lake (Figure 6). Swan Lake has been divided into four management compartments by cross-levees and water control structures. Yazoo NWR includes 65 impoundments, which flood about 2,000 acres, including 650 acres in moist-soil management and 1,350 acres of bottomland hardwood forests that are flooded in the winter to provide habitat for waterfowl. Several impoundments are a combination of habitats, with permanent water (345 acres) in deeper areas and a seasonally flooded forest in the shallow areas.

Yazoo NWR Habitat Types:

Wetlands/Swamps	3,500 acres
Moist Soil	650 acres
Green Tree Reservoirs	1,350 acres
Cropland	3,942 acres
Bottomland Hardwoods	2,293 acres
Reforested	1,507 acres
Grasslands	346 acres
Administrative Lands	118 acres
Total	13,706 acres

Figure 6. Yazoo National Wildlife Refuge current managed habitats



Panther Swamp National Wildlife Refuge

Panther Swamp NWR encompasses 38,697 acres in the middle of the lower Delta along the Will M. Whittington Channel, roughly between Silver Creek on the west and the Yazoo River on the east (Figure 7). Lake George Wildlife Management Area mitigation lands purchased by the U.S. Army Corps of Engineers (COE) and managed by the state border the refuge on the south and southwest. The refuge is situated at a lower elevation than any refuge in the Complex, from 75 feet MSL to slightly over 100 feet MSL. Management is challenged by regular flood events and the expansive beaver population. Beaver dams flood mature bottomland hardwood trees and hardwood reforested areas, causing extensive damage.

Panther Swamp NWR includes a COE overlay area within the acquisition boundary. The COE's 7,067 acres fall primarily in the Big Twist area, lands that were set aside as bottomland hardwood forest mitigation for the COE's Upper Yazoo Basin Project. A perpetual agreement between the COE and Fish and Wildlife Service assigns the Service with management responsibilities for the Big Twist area. As defined in the mitigation agreement, the entire tract must be maintained in bottomland hardwood habitat.

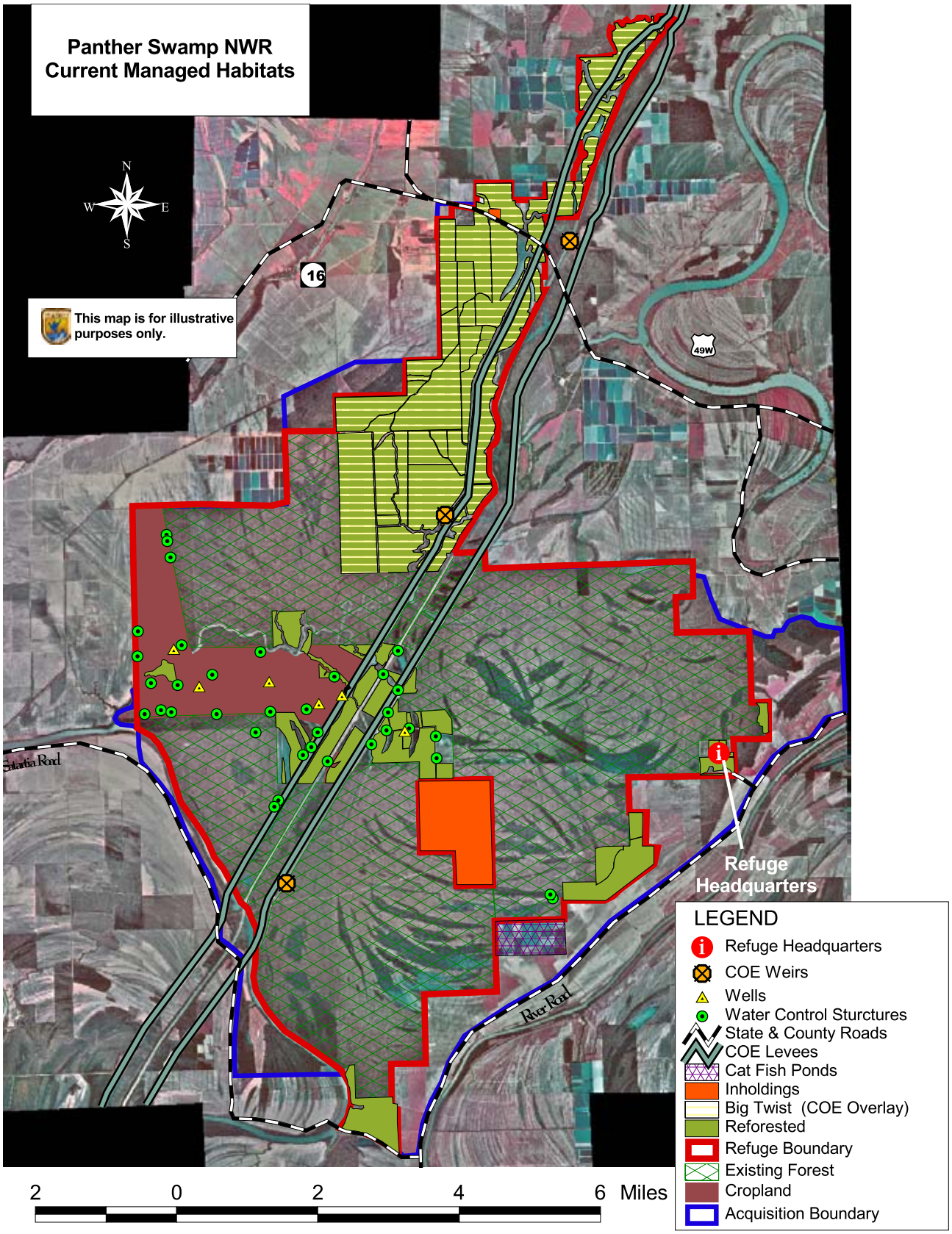
Panther Swamp NWR Habitat Types:

Wetlands/Swamps	5,212 acres
Cropland/Moist Soil	2,350 acres
Grasslands	505 acres
Hardwood Forest	19,933 acres
Early Successional	7,688 acres
Administrative Lands	252 acres
Subtotal	35,940 acres

Carter Tract:

Moist Soil	600 acres
Reforested areas	1,457 acres
Cropland	700 acres
Subtotal	2,757 acres
Total	38,697 acres

Figure 7. Panther Swamp National Wildlife Refuge current managed habitats



Hillside National Wildlife Refuge

Hillside NWR occupies 15,572 acres on the eastern edge of the lower Delta (Figure 8) between the loessal bluffs and the COE levee on the west. The elevation rises from less than 100 feet MSL on the south end to about 135 feet MSL on the north, where Black Creek forms an alluvial fan as it enters the Delta from the hills. The eastern boundary includes a small portion of the loessal bluffs. Within the refuge's boundary, the elevation rises abruptly to 300 feet MSL

Refuge lands were purchased by the COE for its Hillside floodway, "Yazoo Basin Headwater Project." The COE project transformed most of the land into a silt collection sump via a cutoff levee containing the altered channels of the Black and Fannegusha Creeks. The COE project was designed to allow silt to settle out of the water before reaching the Yazoo and Mississippi Rivers, to prevent costly dredging projects. Upon project completion, the land was transferred to the Service for management. The COE retains the right to manipulate water and any ditches it deems necessary. Prior to the COE project the dominant habitat type was bottomland hardwoods. Today willow and cottonwood trees grow in areas affected by the accumulated silt.

Hillside NWR Habitat Types:

Bottomland Hardwood Forest	6,673 acres
Black Willow/Cottonwood	5,010 acres
Croplands	1,448 acres
Early Successional	1,069 acres
Sloughs and Streams	374 acres
Borrow Ponds	285 acres
Other Lands (e.g., roads and levees)	713 acres
Total	15,572 acres

Morgan Brake National Wildlife Refuge

Morgan Brake NWR encompasses 7,383 acres and is located approximately 3 miles north of Hillside NWR (Figure 9). The refuge borders the eastern edge of the Delta adjacent to the loess bluffs. Elevation varies from less than 100 feet to 120 feet MSL at the base of the bluffs. Portions of the boundary include the loessal bluffs, which rise to more than 300 feet MSL. The main wetland features of the refuge are Morgan Brake, which lies half in and half out of the refuge, Around-the-World Brake, and Commander Brake, adjacent to the bluffs.

Morgan Brake NWR Habitat Types:

Bottomland Hardwoods w/ Brakes	3,134 acres
Early Successional	1,623 acres
Former Catfish Ponds	489 acres
Croplands	860 acres
Shrub Swamp/marsh	677 acres
Forested Uplands	570 acres
Administrative Lands	30 acres
Total	7,383 acres

Figure 8. Hillside National Wildlife Refuge current managed habitats

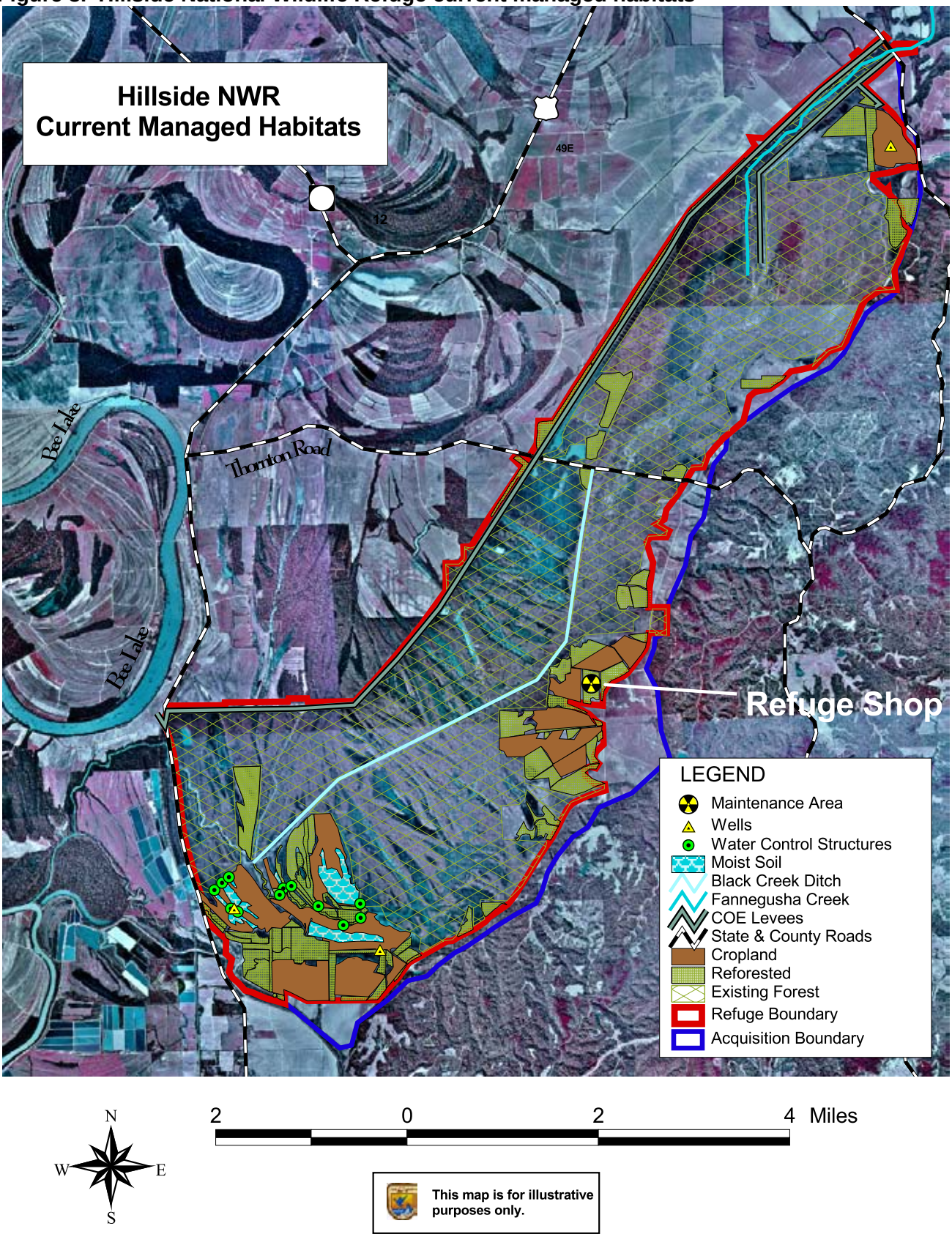
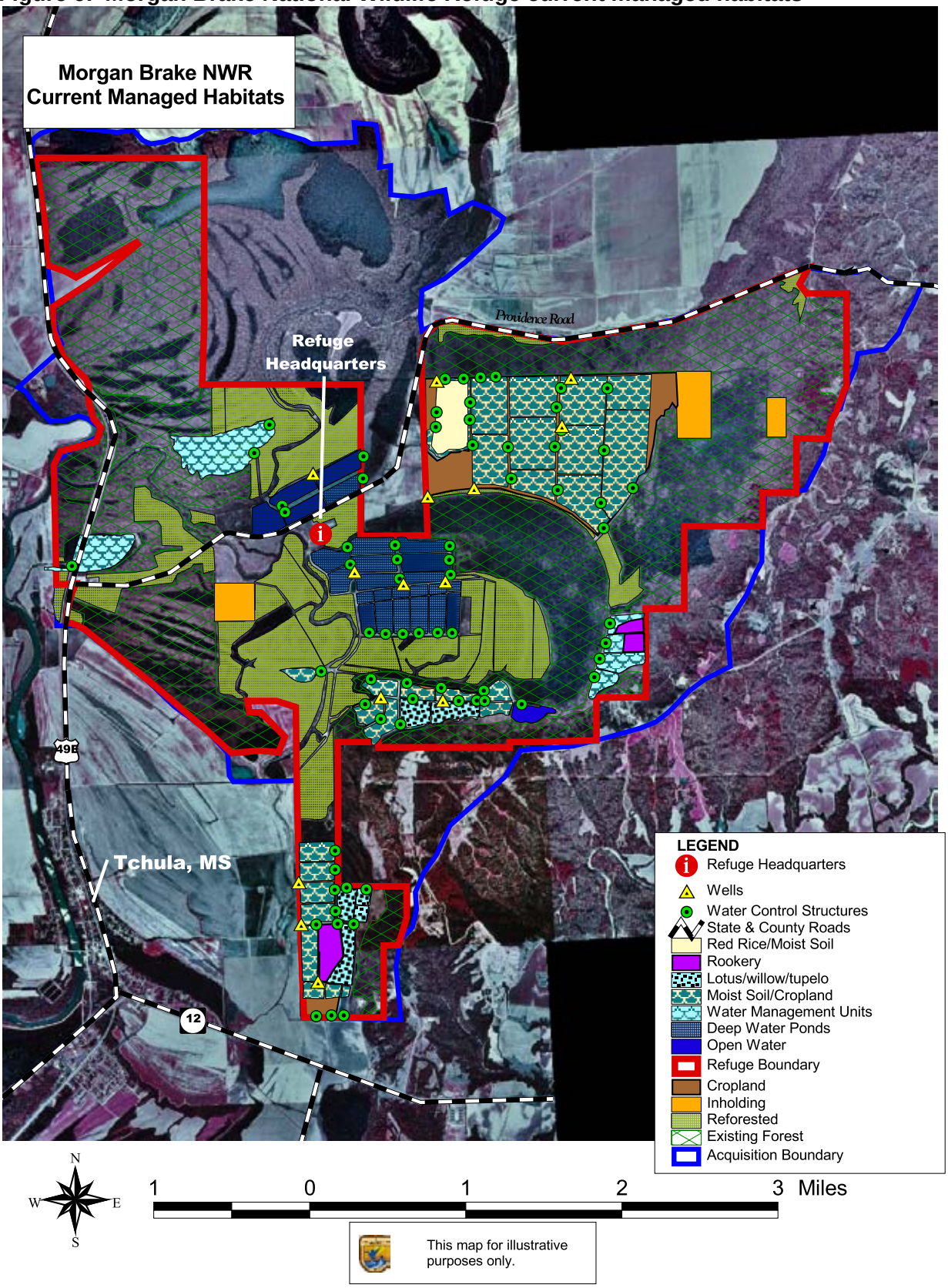


Figure 9. Morgan Brake National Wildlife Refuge current managed habitats



Mathews Brake NWR encompasses 2,418 acres and is located 7 miles north of Morgan Brake NWR (Figure 10). The primary habitat feature is a shallow, 1,810-acre baldcypress/tupelo brake with expansive open water. The majority of the refuge is only accessible by boat. Portions of the Brake are privately owned. Secondary habitat types include 422 acres of bottomland hardwood forest and 186 acres of reforested lands that are in the early successional stages.

Mathews Brake NWR Habitat Types

Cypress/tupelo Brake	1,810 acres
Bottomland Hardwood Forest	422 acres
Reforested Areas	186 acres
Total	2,418 acres

Soils

The alluvial soils in the lower Delta range from silts and clays in the poorly drained areas to sandier, coarser-grained soils on natural levees and ancient sandbars. Most of the soils in the Complex are silts and clays, which have fine texture, low permeability, and high shrink-swell potential. The surface layer is often hard when dry, friable when moist, and plastic when wet, making moisture content an important consideration when working the soil. There are lighter soils in limited areas, such as natural levees, but most of the broad natural levees adjacent to major streams are privately owned cotton production areas.

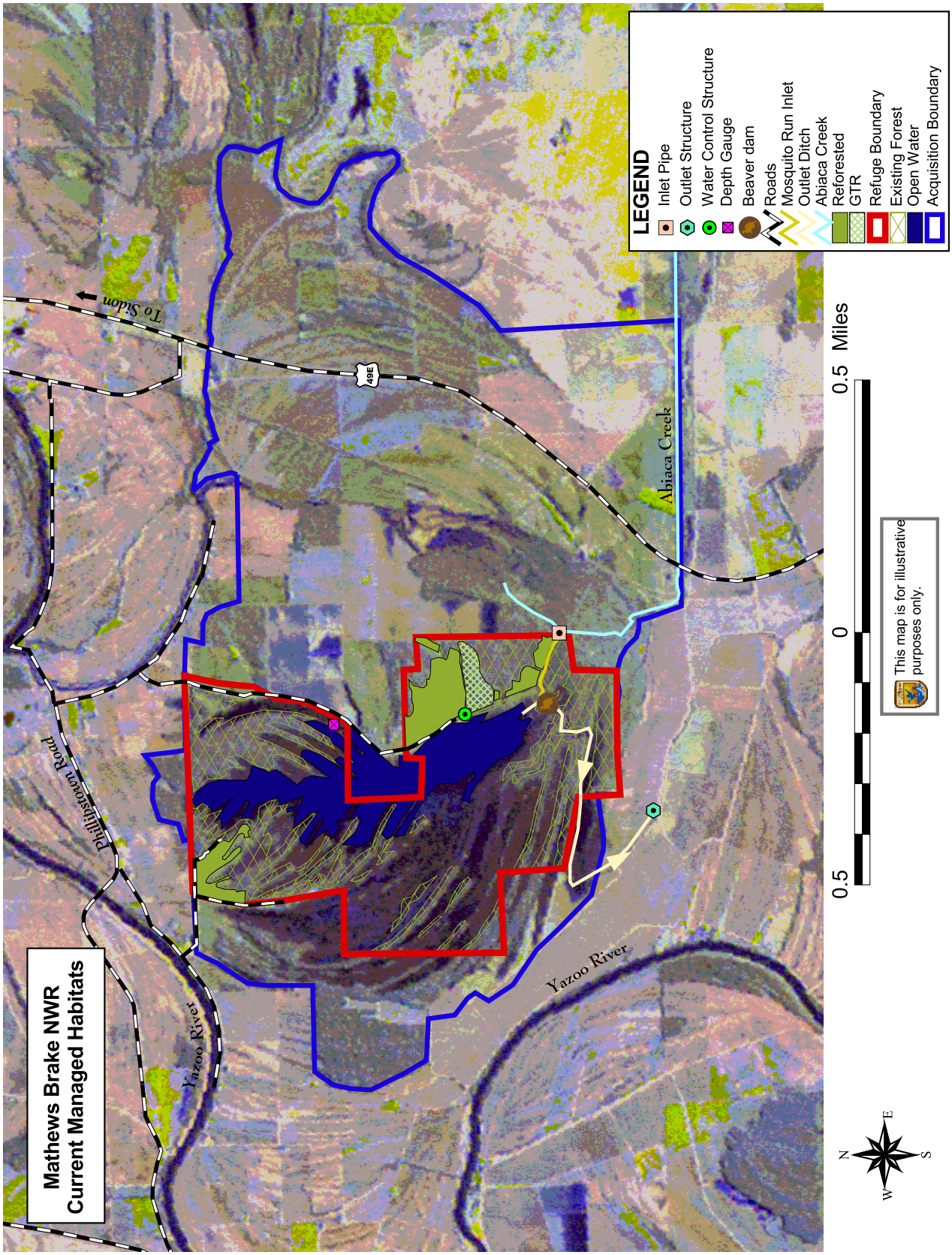
Hydrology

Historically, the refuges were subject to flooding by the Mississippi River in winter and spring. The lower Delta was completely flooded five times between 1882 and 1927, despite the river levee. Since then, the Steele Bayou levee and floodgate have been completed, preventing widespread flooding from the river. However, water from the Yazoo and Sunflower River systems cause annual backwater flooding on Panther Swamp NWR due to its lower elevation.
Floodwaters are often present for 6 months, eventually draining through Panther Creek to the Big Sunflower River on the west side and the Landside Ditch and Lake George on the east, both leading back to the Yazoo River.

Yazoo NWR receives runoff water from a 300-square-mile area of croplands and municipalities to the north. Most of this drainage enters the refuge through Silver Lake Bayou, Ditch No. 11 (locally called No. 9) and Black Bayou. Fortunately, Silver Lake Bayou and Ditch No. 11 no longer flow into Swan Lake, where they were causing serious siltation and contamination problems. As the COE completed the Steele Bayou project, it constructed a channel and levee to divert the flow directly into Steele Bayou from Silver Lake Bayou and Ditch No. 11. The channel and levee keep water from the 300-square-mile watershed from entering Swan Lake. However, drainage swales, ditches, and other channels continue to carry agricultural runoff into Swan Lake from the west side, resulting in eutrophication and pesticide contamination problems in Swan Lake.

Backwater flooding is uncommon on Yazoo NWR and is usually very limited. The COE levee, which lies along the east side of Swan Lake, and separates Swan Lake from Steele Bayou, has a spillway set at 100 feet MSL. Waters rising over 101 feet MSL can overtop some of the major impoundment levees, and spill into Swan Lake. The design elevation of the top of the COE levee is 106 feet MSL.

Figure 10. Mathews Brake National Wildlife Refuge current managed habitats



On Hillside NWR, flooding occurs from headwaters sources in the adjacent hills. Black Creek and Fannegusha Creek deposit large amounts of silt annually on refuge lands in accordance with the COE's Hillside Floodway Project design. However, in a little over half of its projected 50-year life, the silt collection capacity of the land is nearing design capacity. The accumulated silt is producing a build-up of silt deposits and alterations of stream channels, which is most noticeable in the borrow ponds along the northwest side. Shallowing aquatic areas are losing fish as the silt displaces the water. Forest composition and structure have also been altered by the silt deposition and altered hydrological regime.

Morgan Brake NWR receives surface drainage along the east and south boundary and drainage from farmlands north and west of Morgan Brake proper, either from the overflow of Mileston Bayou or directly from smaller drainages and ditches. Chicopa Creek/Spring Branch and Everett Branch coming out of the hills are major tributaries to the drainage. Overflows from Mileston Bayou and Spring Branch often flood a major portion of the refuge. These waters eventually leave the refuge through an arm of Tchula Lake on the west side and Spring Branch flows through the middle of the refuge. Other drainage into the refuge comes from cropland on the southwest side into a forested wetland area. Constant seepage from the hills appears in various places at the base of the bluffs and maintains hydrology in some of the middle hill ponds throughout the year.

Mathews Brake is a shallow lake that formerly filled up from rainfall in the vicinity of the Brake. Abiaca Creek is the natural source of water, but because of silt deposits blocking the mouth, water was diverted each year into the brake from off-refuge. In February 2003, the water source was completely blocked after a significant rain event dislodged a road culvert and allowed sand and sediment-laden water to fill the inflow channel. To remedy the situation, a new channel was constructed in 2004 to direct water from a tributary of Abiaca Creek into the brake. Water levels in the brake are now controlled by two water control structures at the head of the channel. Because a portion of the brake is privately owned, refuge personnel coordinate water level adjustments with the private landowner.

Water Quality

Agricultural runoff from almost any source in the Delta carries organochlorine (OC) pesticides, which are bound to soil particles. These pesticides, heavily used for years in the Delta, have persisted in the soil for over 15 years since their use was banned, and likely will exist for many more. Pesticide contamination is an issue on all refuges in the Complex. Fish and wildlife species are subject to contain OC compounds that may exceed predator protection levels or human consumption concern levels.

A second chemical of concern is polychlorinated biphenyls (PCBs) on Hillside NWR, which receives urban runoff and sewage treatment effluent from the town of Lexington, Mississippi, via Black Creek.

Siltation, whether pesticide-laden or not, is a concern throughout the Complex, particularly in wetlands that receive agricultural runoff, such as Swan Lake on Yazoo NWR, Blissdale Swamp on Hillside NWR, Morgan Brake NWR, Mathews Brake NWR, and the Deep Bayou area on Panther Swamp NWR. Silt diminishes water quality and reduces the capacity for water storage, resulting in a loss of aquatic habitat.

Flora

Prior to European settlement, the Delta cover type was primarily bottomland hardwood forest. Around 1820, settlers began clearing the forest. The dominant forest type was oak-gum-cypress, with canebrakes covering the understory of broad flats on slightly higher ground. Canebrakes were very extensive on natural levees, forming almost pure stands. Most of the surviving forests now occupy low-lying ground that is too wet for agriculture, and are dominated by wet-site species. These wetlands have a fluctuating water level and are semi-dry part of the year. The lowest areas contain cypress and buttonbush throughout the Complex. Cypress is complemented or nearly replaced in some low areas by swamp tupelo on all Complex refuges except Yazoo NWR, where swamp tupelo does not occur. Other woody species in permanent or semi-permanent flooded areas include swamp privet, water elm, black willow, and water locust.

Green ash, red maple, cottonwood, sugarberry, honey locust, sycamore, bitter pecan, overcup oak, American elm, and Nuttall oak dominate slightly higher sites. Extensive flats on Panther Swamp NWR support scattered deciduous holly (possum haw) in the mid-story, while higher elevations support extensive stands of dwarf palmetto (Sabal minor). Hardwoods on still higher sites include willow oak (especially Panther Swamp NWR), sweet pecan, sweet gum, black locust, and water oak. Prominent vines include poison ivy, cross-vine, Virginia creeper, muscadine grape, and false grape in forested areas, and ladies' eardrops, peppervine, and trumpet creeper in more open sites.

Vegetation associations vary among the refuges. Panther Swamp NWR has distinctively lower ground with fewer areas that can support species found on well-drained soils. Yazoo NWR has more topographic relief with distinct ridges and greater overall diversity. One ridge (<10 feet high) on Yazoo NWR has Shumard oak and bitternut hickory, both of which are rarely seen in the lower Delta.

The loessal bluffs adjacent to Hillside and Morgan Brake NWRs support a completely different floral assemblage. Some trees, such as northern red oak, swamp chestnut oak, Florida maple, yellowwood, and cucumber tree are considered unusual in the Delta. American beech, tulip poplar, white oak, red buckeye, and hornbeam, among other species, occupy the lower and middle loess slopes, with flowering dogwood, southern red oak, and black gum at the top of the bluff. Refuge staff identified 44 species of woody plants on a cursory survey of a very small area on the bluff. Herbaceous species included abundant jack-in-the pulpit, Christmas fern, and trillium.

Fauna

Mammals:

Mammals occurring on the Complex represent most of the extant species in the Delta. Large mammals include the abundant white-tailed deer, feral hogs (an invasive species found primarily on Panther Swamp and Morgan Brake NWRs), and the Louisiana black bear which has been seen most recently on Yazoo NWR. In 2004, four Louisiana black bears were seen on Yazoo NWR. Refuge staff collaborated with the Mississippi State Bear Biologist to capture the visiting 115-pound male black bear on the refuge and fit him with a radio collar to track his subsequent travels. Radio telemetry revealed later that the bear remained on the refuge after the trapping event, well into the winter hibernation period.

Medium-sized mammals occurring on the Complex include opossum, armadillo, eastern cottontail and swamp rabbits, beaver, muskrat, nutria, coyote, red fox, gray fox, raccoon, striped skunk, river otter, and bobcat. Nutria populations (introduced from South America) cause significant habitat damage, as do beavers, especially on Panther Swamp NWR. During the latter half of the 20th century, armadillos extended their range into the Delta region of Mississippi. Their impact here has not been fully investigated. Coyotes are a recent arrival, with the first refuge sightings recorded in the mid-1980s. Their presence is thought to be responsible, among other things, for the scarcity of foxes. River otters appear to have made a comeback in recent years. Raccoons are abundant and tend to overpopulate. Surveys for small mammals have not been conducted, but the following species are thought to inhabit complex refuges.

Species	**# of species**
Shrews	3
Bats	12
Chipmunks	1
Squirrels	3
New world rats and mice	7
Voles	1
Old world rats and mice	3
Weasels	1
Mink	1

Birds

More than 225 species of migratory birds use the Complex, with 77 species breeding on Complex lands. Ten species with Partners-in-Flight “concern scores” of 20 or more are common or abundant, including prothonotary warbler, painted bunting, red-headed woodpecker, yellow-billed cuckoo, wood thrush, white-eyed vireo, yellow-breasted chat, Carolina chickadee, loggerhead shrike, and dickcissel.

Mallards are the most abundant wintering waterfowl species, followed variously by gadwall, greenwing teal, pintails, and shovelers. Snow geese occupy Morgan Brake NWR and Yazoo NWR in large numbers during winter, with flocks sometimes exceeding 100,000 birds. Wood ducks and hooded mergansers are common nesters in the spring and summer, depending on the size of the nest box program on each refuge.

Wading bird rookeries exist on Yazoo, Hillside, and Morgan Brake NWRs. Nesting species include the great blue heron, great egret, snowy egret, little blue heron, cattle egret, black-crowned night heron, anhinga, tricolored heron, and, more recently, the double-crested cormorant. White ibis have occupied rookeries on Morgan Brake NWR in the past, but currently are the dominant species using a large rookery adjacent to Panther Swamp NWR.

About 20 species of shorebirds use the Complex, especially Yazoo and Morgan Brake NWRs, where moist-soil habitat is managed intensively. Some of the most numerous species are least sandpipers, pectoral sandpipers, lesser yellowlegs, and stilt sandpipers.

Reptiles

Although a formal survey of reptiles has not been conducted on any of the refuges, a list of species has been prepared based on species ranges and personal encounters by refuge staff. The list includes American alligators, turtles (15 species); lizards (7 species); and snakes (27 species). A survey of the loessal bluff area may expand the list by revealing a variety of predominantly upland species.

Several species of water snakes are common or abundant, especially the broad-banded, diamond-backed, and green water snakes. Poisonous snakes include the copperhead, cottonmouth, and timber (canebrake) rattlesnake. Panther Swamp NWR is known for a high population of cottonmouths. Rat snakes of mixed or uncertain subspecies, are significant nest predators, and are abundant on the Complex. Racers are common. The most common turtle species is likely the red-eared turtle. Alligator snapping turtles are locally abundant and common snapping turtles are located throughout the Complex. Soft-shelled turtles occur in some waterways. The ground skink and the broad-headed skink are two of the most common lizard species.

Amphibians

Although calling frog surveys and searches for salamander breeding sites have been conducted on Yazoo NWR, no formal surveys have been conducted Complex-wide. The numbers of species that may occur on the refuge include: salamanders (7); toads (2); treefrogs (6); chorus frog (1); narrow-mouthed toad (1); and true frogs (5). Cricket frogs, green treefrogs, bullfrogs, and southern leopard frogs are abundant. Bronze frogs are present and in some areas are common. Central newts or ambystomatid species are rarely encountered. Few breeding sites have been identified. Sirens or amphiumas are common in suitable habitat, which is widespread.

Fish

Fish populations consist mostly of rough fish, which can withstand hot, murky water with low oxygen content, including long-nosed gar, buffalo, carp, bowfin, and catfish. Sport fish include largemouth bass, bream (sunfish), and channel catfish, which have been stocked in suitable waters such as certain borrow ponds on Hillside NWR and former catfish ponds on Morgan Brake NWR selected for public fishing use. A wide variety of fish species exists in the streams and bayous, including largemouth bass, various bream, and crappie. When flooded, Panther Swamp NWR is accessible to paddlefish, pallid sturgeon, and other species using the Lower Mississippi/Yazoo River drainage system.

SOCIOECONOMIC ENVIRONMENT

Refuges in the Complex are located in Yazoo, Holmes, Leflore, Washington, and Humphreys counties. In addition, several Farm Service Agency properties with management responsibilities assigned to the Complex also occur in Issaquena, Warren, and Madison counties. All of these counties are located within an area locally referred to as the “Delta”, except those in Madison County. The Delta is typically characterized as rural, with an economy based on manufacturing and the production of catfish, cotton, soybeans, corn, and rice. Most of the counties’ land bases are in agriculture (Table 4). The largest communities in these counties are Greenville (Washington County), population 41,633; Yazoo City (Yazoo), population 14,550; Greenwood (Leflore), population 18,425; Durant (Holmes), population 2,932; and Belzoni (Humphreys), population 2,663.

Table 4. Percent of land base used for agricultural production in counties surrounding Complex refuges

County	Total Area (square miles)	Area used for agriculture (%)
Washington	733	536 (73%)
Yazoo	933	488 (52%)
Humphreys	430	310 (72%)
Holmes	759	297 (39%)
Leflore	605	418 (69%)

(Source: USDA, 2003)

Mississippi is the most economically depressed state in the nation (Tables 5 and 6), and the counties in which the refuges are located contribute significantly to this economic depression. These counties rank below the national averages for employment, education, and average income. Unemployment figures in 2002 varied from 8 percent in Yazoo County to 18 percent in Holmes County.

Table 5. Employment data for counties surrounding Complex refuges

County	Leading Industry	Percent of Earnings	Earnings	Unemployment Rate*
Yazoo	Manufacturing	27.2%	$266,380	8.0%
Leflore	Government	26.9%	$484,569	10.0%
Washington	Services	28.0%	$790,354	11.2%
Holmes	Government	30.9%	$118,981	18.0%
Humphreys	Government	23.4%	$109,196	11.7%

*Mississippi's average unemployment rate is 5.7 percent. (Source of statistics: Department of Mississippi Development Authority 2002)

Table 6. Demographics for Complex vicinity.

County	Land Area (sq. miles)	Popu-lation	% pop. change (1990-2000)	Median Age	Per capita Income	**% below poverty	% White	% Black	% Hispanic	% Asian	% Native American
Washington	733	61,827	-7.3	31.5	$19,237	25.8	34.0	64.6	0.8	0.5	0.1
Yazoo	933	27,809	10.4	33.7	$17,314	28.9	44.7	54.0	4.4	0.2	0.2
Humphreys	430	11,206	-7.6	30.5	$17,054	32.0	27.2	71.5	1.5	0.3	0.1
Holmes	759	21,476	0.0	29.7	$13,424	33.0	20.5	78.7	0.9	0.2	0.1
Leflore	605	37,316	1.6	30.1	$18,809	27.2	30.0	67.7	1.9	0.6	0.1

Source: Mississippi Development Authority, 2002-03 Community Profile data, U.S. Census Bureau,
**1998 and 2000 data, “The Changing Delta, 1990-2000," Tom Kersen 2002

Recreation

Public hunting and fishing provide the primary source of recreation activities on the Complex, as regulated by various federal and state laws. Hunting is the most popular recreational activity on refuges in the Complex. The Complex contains large populations of fish and wildlife, including a number of game species. Public hunting programs for deer, rabbits, squirrels, raccoons, waterfowl, doves, and turkey are available during authorized hunting seasons.

All hunting and fishing programs are monitored and partially funded through general ($12.00) and limited draw ($12.50) hunt permits and fees. Each year approximately 5,800 general recreation permits are issued for hunting and fishing, and approximately 2,000 special limited hunt permits are issued to hunters for white-tailed deer and wild turkey. Certain portions of the refuges are inaccessible to passenger cars or pickups. Hunting access is therefore provided by a limited number of ATV trails that are open to ATV traffic only during the hunting season.

Fishing is the second most popular activity on the refuge. In 2004, 14,490 visits were associated with fishing (Complex Refuge Management Information System 2004 data). Most fishing occurs on Mathews Brake NWR where access is provided via a boat ramp on the east side, and on Panther Swamp NWR where access is provided by two boat ramps, one at Lake George and the other at Deep Bayou.

Wildlife observation and photography is encouraged on all refuges in the Complex. A few trails provide opportunities for hiking, and many refuge roads are also open to the public. Each year several special use permits are issued to photographers. Two new disabled accessible wildlife observation platforms are available for the public at Yazoo NWR, and one disabled accessible interpreted nature trail is available at Hillside NWR. Although occasional visitors stop by to observe wildlife and take a few pictures, most wildlife observation and photography is associated with hunting and fishing because the Complex lacks the staff and resources to establish formal programs that would expand or improve participation.

Environmental education and interpretation are provided upon request, but there are no refuge-specific programs and no staff available to develop and conduct effective education and outreach programs. The Complex has no camping facilities.

In 2004, refuges in the Complex counted approximately 163,105 visitor-use days for all activities (Complex Refuge Management Information System 2004 data).

Outdoor Recreation Economics

Fish and wildlife habitats and species associated with the Delta are economically important. Local businesses benefit from hunting and recreational fishing, wildlife viewing and photography, and commercial fishing (Table 7). Resident and nonresident hunting and fishing revenues for the state totaled $13.7 million for 525,479 licenses (Mississippi Development Authority 2002).

In addition, $6.2 million in resident and nonresident fishing license revenues were reported in FY 2002.

Table 7. Activities by participants, 16 years old and older, throughout Mississippi

Activity	Number of Partici-pants	Activity Days	Avg. Days per person	Total Expenses ($1,000)	Trip-related Expenses ($1,000)	Equip-ment and Other ($1,000)	Average $ per person	Avg. Trip Expenses per day
Fishing	*586,000	9.5M	16	$211,000	$118,000	$93,000	$363	$13
Hunting	**357,000	8.5M	24	$360,000	$132,000	$227,000	$969	$16
Wildlife Obser-vation	***631,000	NA	NA	$303,000	$36,000	$267,000	$481	NA

*136,000 Nonresidents, 450,000 residents
**111,000 Nonresidents, 245,000 residents
***55,000 Nonresidents, 576,000 residents

(Source: 2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation in Mississippi)

Wildlife-dependent recreational opportunities contribute to the economic base for rural communities. The Complex can enhance existing opportunities through improved access, facilities, and staffing. Hunting and fishing, and more recently, eco-tourism involving wildlife observation, photography, and environmental interpretation are increasingly being viewed as desirable industries. Land alterations and development for agriculture and other purposes have resulted in the loss of valuable fish and wildlife habitat. Refuges in the Complex serve a vital role, not only by restoring, protecting, and providing habitat for a diversity of plant and wildlife species, but also by providing natural areas where people can enjoy wildlife observation, photography, hunting, or fishing.

Tourism

Music, festivals, historical sites, and outdoor recreation are some of the tourism opportunities available, but infrastructure and expertise is lacking to effectively position the Delta as a cultural tourism or outdoor recreation destination. The State of Mississippi has initiated plans to develop the "Mississippi Millennium Blues Trail," which would pass through the counties surrounding the Complex. The Mississippi Department of Transportation (MDOT) is working to designate Highway 1, which borders the west side of Yazoo NWR, as a state scenic highway. MDOT's next step is to support the designation of Highway 1 as a Federal Scenic Highway. Overall, tourism (excluding hunting and fishing) in Washington, Holmes, Yazoo, Leflore, and Humphreys counties does not currently contribute significantly to the local economy (Table 8). Washington County generates additional revenues from casinos located along the Mississippi River, but offers few other established attractions that regularly draw tourists to this area.

CULTURAL ENVIRONMENT

Prior to Old World settlement, several Native American tribes inhabited the Delta. North of the Complex, the Quizquiz tribe was a predecessor of the historic Tunica. Only one village of Quapaw was identified in 1763, with the rest in Arkansas. The Yazoo, Koroa, and Tunica tribes occupied areas along the lower Yazoo River. The first Europeans to travel through the Delta were the Spaniards of De Soto's 1540 expedition. The French arrived in the mid-1600s. They noted many

tribes; however, nearly all the tribes mentioned by the French in the mid-1600s had disappeared by 1750, due to the introduction of European diseases that killed many, warfare, and migration. In 1803, the land was sold to the United States as part of the Louisiana Purchase (Heisler 1978).

Table 8. Estimated county tourism and recreation (T&R) revenues/employment

County	Total T&R Revenues	Total T&R Employment	Total Establishment Based Employment	T&R Employment Percentage
Washington	148,053,836	1,565	23,050	6.8%
Yazoo	11,874,082	150	6,600	2.3%
Leflore	29,476,106	475	16,340	2.9%
Humphreys	2,173,617	27	3,060	0.9%
Holmes	4,205,929	67	4,230	1.6%

(Mississippi Development Authority, Division of Tourism 2003)

Numerous cultural resource inventories have been completed on approximately 25,000 acres throughout the Complex (Table 9). Comprehensive surveys were conducted on Yazoo, Mathews Brake, and Hillside NWRs prior to and following land acquisition. The only refuge in the Complex that has been identified as containing significant cultural value (to date) is Yazoo NWR. Five properties on Yazoo NWR are eligible for the National Register of Historic Places, including the Swan Lake Indian mounds, Deer Lake Village, Deer Lake Village South, the Steele Bayou site, and the Big Lake site. The five sites were nominated for the Register in 1973; however, the State has not yet completed the process, and further coordination with the State Historic Preservation Officer and the Service's Regional Archaeologist is needed to move this process forward.

Previous cultural resource surveys have recommended that the Swan Lake Indian Mounds be closed to the public. However, the Indian Mounds are the most obvious and well-known cultural resource site in the area. The impressive Temple Mound on Yazoo Refuge Road is a source of great curiosity by the visiting public, and the refuge's proximity to the Winterville Mounds and Museum in Greenville, Mississippi, increases the likelihood that visitors in the area will stop by and visit the refuge's mounds. Only minimal infrastructure would be required to prepare the Temple Mound for interpretive display.

Table 9. Archaeological surveys conducted on the Complex to date

Refuge	Acres Surveyed	Known Archeological Properties	Properties eligible for the NRHP*
Yazoo	5,000	27	5
Panther Swamp	175	0	0
Hillside	15,406	0	0
Morgan Brake	2,000	0	0
Mathews Brake	2,418	0	0

*NRHP= "National Register of Historic Places"
(Source: Central MS Complex Cultural Resource files)

Indian Mounds

Although the first people may have entered what is now Mississippi about 12,000 years ago, the earliest major phase of earthen mound construction in this area did not begin until approximately 2,100 years ago. Mounds continued to be built sporadically for another 1,800 years. Of the mounds that remain today, some of the earliest were built to bury important members of local tribal groups. The burial mounds were usually rounded, dome-shapes. Later mounds were rectangular, flat-topped, earthen platforms upon which temples or residences of chiefs were erected.

Eight hundred years ago the Delta was home to highly organized societies. There were roads, commerce, and cultural centers anchored by awe-inspiring earthen monuments. Wonders of geometric precision, these earthworks were the centers of life. However, mound construction was in a period of decline in the 1500s when the first Europeans arrived in the region and brought epidemic diseases, which decimated native populations across the Southeast. As a result, by the time sustained contact with European colonists began around 1700, the long tradition of mound building was reaching its end. Today mounds owned by state or federal agencies are protected along with the lands for which those agencies are responsible. Most of the mounds in Mississippi, however, are on privately owned land. Many mounds have been irreparably damaged or completely destroyed by modern development and looting. As a result, Indian mounds are critically endangered cultural sites. (Indian Mounds of Mississippi, National Park Service 2002).

III. Plan Development

OVERVIEW

Early in the draft plan development process, the planning team identified a list of issues and concerns that were likely to be associated with Complex conservation and management. The list of issues grew with the addition of concerns from governmental partners and the public.

PUBLIC INVOLVEMENT AND PLANNING PROCESS

The planning process was initiated with a meeting of planning team members in August 2000. The planning team subsequently identified an initial list of issues and prepared a mailing list that included the general public, adjacent landowners, state agencies, private organizations, governments, and other interested parties. Letters were mailed to individuals and groups on the mailing list to explain the comprehensive conservation planning process and to request permission to include them on future meetings. The letters also requested that the recipients identify other individuals who may be interested in the planning effort. In addition, announcements were made at meetings of civic groups and public service announcements were aired on local radio stations.

Three refuge biological reviews (Yazoo and Panther Swamp NWRs, and a combined Hillside, Mathews Brake, and Morgan Brake NWRs) were conducted between October 2000 and January 2001 to obtain recommendations for future refuge management activities from a diverse team of Fish and Wildlife Service staff, federal and state agency representatives, non-governmental organizations (NGOs), and universities. The combined expertise of the group represented the most respected and experienced wildlife and habitat managers in the state. The diverse range of interests among these groups provided the means for a critical examination of current programs. The reviews produced a range of alternatives that identified data needs, habitat objectives, opportunities for improvement, and other information, while lending support to future partnership opportunities on mutual interests.

Three separate reports summarized the recommendations submitted by the biological review teams. In February 2001, two refuge public use reviews (Yazoo/Panther and Hillside/Mathews/Morgan) were completed. The public use review team (comprised of Service staff) developed a “Public Use Review Report” for each of the refuges that outlined recommendations made in the field. In May 2001, three public scoping meetings were conducted to obtain information and concerns from individuals and groups occupying the communities around the five refuges. Meeting announcements were sent to everyone on the mailing list, and flyers were distributed with details about the meetings. Articles announcing the meetings were published in newspapers and magazines, and announcements were made on radio and television stations.

A presentation at the beginning of each meeting outlined the planning process, the purpose(s) of each refuge, and the mission of the National Wildlife Refuge System. Participants were assigned to groups and each group was provided with individuals who served as facilitator and recorder for that group. Each group completed an “Issues Worksheet,” which gave an indication of the value each person placed on the Complex’s various resources.

Following the “Issue Worksheet” outline, participants were asked to present specific issues related to each topic (e.g., waterfowl, shorebirds, hunting, and law enforcement). All comments and issues were recorded. At the end of the meeting, all worksheets were collected. The worksheet also provided an additional comment section to accommodate those individuals who felt more comfortable providing their comments in writing. Additional “Issue Worksheets” were mailed to those individuals

and groups on the mailing list who did not attend the meetings. Several letters were received from interested parties and organizations addressing their concerns for the future management of the Complex. The draft plan considered all input obtained from the meetings and the correspondence.

Although no local tribes are located in the area, letters were sent to the tribal chairs of the Quapaw and Tunica tribes of Oklahoma and Louisiana, respectively. The letters explained the planning process and requested that they contact the planning team if they had any tribal lands in the area or concerns about planning. No response was received.

The biological and public use reviews and scoping meetings provided a list of issues that participants believed needed to be addressed in the comprehensive conservation plan. Alternatives to address identified issues were developed (Environmental Assessment, Section B). The preferred alternative formed the basis for selection of objectives and strategies that are expected to achieve the goals identified by the planning team. This process ensured that the more important issues would be resolved or given priority over the life of the plan.

ISSUES

FISH AND WILDLIFE POPULATIONS

Threatened and Endangered Species

The protection and recovery of threatened and endangered plants and animals is an important responsibility of the Service and the Service's national wildlife refuges. Several threatened and endangered species use or could use the Complex, including the bald eagle, Louisiana black bear, pondberry, interior least tern, and pallid sturgeon.

Recovery plans for the Louisiana black bear address the need to eventually reestablish a population within its historical range, including the State of Mississippi. Large blocks of interior forest, such as the forest on Panther Swamp NWR and the neighboring Delta National Forest, could serve as potential sites for reestablishment. Until recently, most restoration efforts have been focused on the Louisiana black bear within the State of Louisiana. However, bear sightings in the lower Mississippi Delta have increased over the last few years, suggesting a possible expansion of these bears across the Mississippi River from existing natural and repatriated bear populations in Louisiana and Arkansas. Some discussion among black bear conservationists have identified Panther Swamp NWR as a potential site for reintroductions as early as 2006.

Pondberry, an endangered plant species, is known to occur on areas surrounding the Complex (e.g., Delta National Forest). No formal surveys have been conducted on the Complex to identify colonies of this rare shrub, but there have been attempts by USDA Forest Service researchers to reestablish and study small plantings of pondberry on various refuges. A formal survey needs to be conducted to determine whether any plant communities exist, particularly on Panther Swamp NWR, which is adjacent to Delta National Forest.

Bald eagles nest in areas near Complex refuges, but no known nests occur on the refuge lands. Eagles are often seen during the winter months when waterfowl numbers are abundant and they are occasionally seen perched in trees near larger refuge water bodies. Surveys during the nesting season are needed to determine possible eagle nesting on the Complex.

The pallid sturgeon is known to occur in drainage systems connected to refuge waters, but no formal surveys or studies have been conducted. Such surveys or studies need to be initiated.

Invasive Species

An "invasive species" is defined here as a species 1) that is non-native (or alien) to the ecosystem under consideration and 2) whose introduction causes or is likely to cause economic or environmental harm or harm to human health (Executive Order 13112). Invasive species can be plants, animals, and other organisms (e.g., microbes). Human actions are the primary means of invasive species introductions.

Several invasive species occur on the Complex. Some of the more prominent and obvious are feral hogs, coyote, nutria, and armadillo. These species were either accidentally released and became acclimated to living in the wild, were intentionally released for sport or trade, or have expanded their ranges. These invasive species have been sporadically suppressed by lethal means.

Invasive plants, insects, and smaller organisms are more difficult to recognize and monitor. The Complex does not have an invasive species monitoring program to detect initial introductions, rate of spread, and impacts. However, several invasive plants, such as alligator weed and kudzu, are known to occur in widespread areas across the Complex, overtaking native vegetation. Attempts at control have been opportunistic and sporadic, using both biological and chemical means.

The Complex does not have a formal “Invasive Species Management Plan.” There are currently no structured programs or funding specifically provided for an invasive species management program. However, a plan will be developed and implemented by 2006, subject to available staff and funding.

Resident Wildlife

The primary mission of the Fish and Wildlife Service and the Refuge System is the protection of federal trust species (migratory birds, threatened and endangered species, anadromous fish, and marine mammals). Responsibility is also assumed for managing resident wildlife that is dependent on refuge resources, but not to the exclusion or detriment of the purposes for which a refuge was established. A variety of wildlife species indigenous to the LMRAV inhabit the Complex. Some species are readily recognized by the general public, including white-tailed deer, wild turkey, cottontail rabbits, and others. Animals that are valued by the public for hunting opportunities are elevated in importance to land managers with hunting programs.

The vision of the Refuge System “requires us to maintain the biological integrity, diversity, and environmental health of the Refuge System.” To better understand the biodiversity and environmental health of refuge lands, baseline information on wildlife and their habitats must be collected. These data will document presence or absence, monitor trends, and identify the impacts of refuge programs on species. Historically, most land managers in the Refuge System focused management efforts on more common, sometimes recreational, wildlife species. However, the Refuge System’s mission does not give preference to any one group of species, except for an overriding responsibility to protect and manage habitat for federal trust species (migratory birds, threatened and endangered species, anadromous fish, and marine mammals).

Each biological review team member recognized that the Complex lacked specific data on many resident wildlife species, particularly nongame wildlife, such as reptiles, amphibians, mussels, insects, small mammals, and their habitats. Most efforts to collect data on resident wildlife have focused on studying and managing game species, such as white-tailed deer. While it is recognized that this is an important animal, especially to the habitat and hunting public, dozens of refuge wildlife and plant species deserve study. The needed studies on species and habitats will require additional staff and funding.

The northern bobwhite quail historically and traditionally has been one of the most popular game birds in the south. Around the turn of the twentieth century, bobwhite quail numbers reached all time highs, but since then have been in constant decline. Land use practices from 1900 through the 1950s produced habitats that were conducive to the birds. Early settlers carved out small farms in large expanses of forests and along with the associated grazing of livestock and cropping, provided the right mosaic of early successional habitats that the birds require. However, for the last several decades, bobwhite quail and many other small game species associated with early successional stages and grasslands have declined at an average of three percent per year. In the last 10 years, the rate of decline has increased to about six percent per year. While many factors have contributed to this decline, including predators, pathogens, and pesticides, deteriorating habitat quality is the primary cause of decline. This is due to advanced natural succession, intensive monoculture farming, more intensive timber management, reduction in prescribed burning, and the extensive use of exotic grasses, such as fescue and Bermuda.

Agricultural farming practices have become more mechanized, and chemical control for pests has increased dramatically. Small patchwork farms that once provided nesting, brood rearing, and protective cover have been replaced by large monoculture farm operations that have eliminated thousands of miles of weedy ditch banks and fence rows. Bobwhite quail prefer an interspersion of woodlands, brush, grass, and croplands. Currently, there are no active management programs for quail throughout the Complex. However, coveys of quail have survived and expanded in favorable habitats existing on Panther Swamp, Hillside, and Morgan Brake NWRs.

Wild turkey, an upland game species, can be found on every refuge in the Complex, except Mathews Brake NWR. Flooding and predation have caused dramatic population declines in the past, causing the closure or limiting of wild turkey hunting seasons. Monitoring efforts should be initiated to ensure that populations are not over-harvested on those refuges that offer wild turkey hunting programs. Management actions for quail and grassland birds would also benefit turkey production and survival. Many comments were received requesting the active management of these upland game birds in particular to provide a huntable population.

White-tailed deer have the potential to adversely affect habitats unless their numbers are kept at or slightly below the carrying capacity. The Complex refuge hunt program is designed to maintain the herd while offering quality hunting opportunities to the public. An appropriate harvest (related to habitat conditions) has been maintained with occasional fluctuations due to weather and habitat conditions. Population level indicators could include monitoring, harvest data, and periodic health checks.

Hunting programs provide opportunities for raccoon, rabbits, squirrel, and the incidental taking of beaver, coyote, and feral hogs during hunt seasons because overpopulation of raccoon, beaver, coyote, and feral swine adversely impact other species. For example, raccoon predation on the nests of turkey, wood ducks, and songbirds can limit their reproductive success. Raccoon also spread canine distemper, a common close-contact disease, to other species such as fox. Beaver have become pests, building dams that hold water on trees, causing massive die-offs of large tracts of mature bottomland hardwoods, which take decades to recover. On Panther Swamp NWR, trapping efforts by staff, volunteers, and the issuance of special use permits to commercial trappers have not effectively reduced these losses.

Migratory Birds

Ducks. Most refuges in the Complex (except Hillside, Holt Collier, and Theodore Roosevelt NWRs) have legislated purposes that set higher priorities for migratory birds than all other wildlife species. These purposes guide the primary operation and management actions on the refuges. Habitat management actions include providing agricultural "hot foods" such as rice, corn, milo, and millet and managing and maintaining moist-soil areas and forested wetlands to meet the feeding, resting, and breeding needs of migratory and resident waterfowl. Comments of biological review teams and the public provided overwhelming support to continue or expand habitat management programs for migratory and resident waterfowl, with specific stipulations for improving and focusing efforts.

To support the North American Waterfowl Management Plan, the LMVJV office assigned each refuge with a minimum acreage of habitat, objectives to provide sufficient water, food, sanctuary, and resting/loafing areas to meet the needs of wintering waterfowl. The objectives are based on the best available information; however, there are currently several research projects in progress that study the available resources and habitats on private lands. The results of these studies will likely alter refuge habitat management objectives in the future.

Particular attention was given to the amount of refuge croplands and moist-soil areas needed to meet habitat objectives and to the numbers of waterfowl that these cropland and moist-soil areas can support. Lands currently in agricultural crops that exceed acreages needed to meet objectives would be evaluated for conversions to moist soil, early successional habitats, or reforestation to address the needs of other species of migratory and nonmigratory birds and mammals. Providing undisturbed waterfowl sanctuaries, while at the same time providing quality hunting opportunities, is another issue that must be addressed.

Geese. Geese were addressed separately due to their unique habitat needs compared to ducks. Goose species, including snow, white-fronted, and Canada, prefer feeding and resting in open fields with little or no standing water. Thousands of geese winter on Yazoo NWR with minimum historic use on the remaining Complex refuges. In particular, large concentrations (>100,000) of snow geese routinely feed and loaf on agricultural lands on and around Yazoo NWR from November through January. These large concentrations have a significant impact on crops planted for wintering ducks. Minimum acreage objectives for "hot foods", including small grains and green browse, were obtained based on preferred overwintering populations. The acreage and crops would be provided in areas that meet the feeding and resting habitat requirements needed by geese. Any management actions for snow geese should support the "Arctic Tundra Habitat Emergency Conservation Act," to reduce the snow/Ross' goose populations that have shown rapid population growth, reaching levels that damage habitats on their arctic and sub-arctic breeding areas. The degradation negatively impacting other bird populations that are dependent on the habitat may be irreversible. Natural marsh habitats on some migration and wintering areas also have been impacted. Goose damage to agricultural crops has also become a problem. There is increasing evidence that lesser snow and Ross' geese act as reservoirs for the bacterium that causes avian cholera. The threat of avian cholera to other bird species likely will increase as these goose populations expand.

Nongame Birds

Neotropical migratory birds. These birds are a species group of special management concern. Broad species groups include breeding forest landbirds, breeding scrub/shrub landbirds, transient song (land) birds, marsh and grassland birds, shorebirds, colonial waterbirds/wading birds, and raptors. The Partners-in-Flight Bird Conservation Plan for the LMRAV has habitat objectives for these groups of birds, but all of the groups can be accommodated on existing and restored habitats throughout the Complex.

Habitat needed for the most area-sensitive species (interior forest-dependent birds) has been evaluated and objectives have been established. Each of the four refuges (except Panther Swamp NWR) has one 10,000-acre interior forest objective. Two 100,000-acre forest objectives have been identified for the LMRAV, including one that combines Panther Swamp NWR with Delta National Forest and the Lake George Wildlife Management Area. Interior forests in 10,000-acre and 100,000-acre blocks are extremely rare along the entire LMRAV due to land clearing, primarily for agriculture. In spite of the loss of important forest and wetland habitat along the LMRAV, the birds continue to follow their historical migratory pathways along the Mississippi Flyway. This has resulted in a direct correlation between the decline of forests and the decline of populations of bird species, particularly those with sensitive habitat needs. Balancing the needs of waterfowl, including geese, which require more open habitat, with the needs of imperiled songbirds, which require forest habitat, is an important issue that has generated much discussion.

Another issue is lack of baseline information on all these groups of birds throughout the Complex. There have been some limited surveys on specific areas on the Complex (e.g., shorebird surveys on the Cox Ponds), but no comprehensive or standardized surveys have been conducted on all of the refuges and habitat types.

Shorebirds. Habitat for spring (northbound) shorebird migration in the LMRAV is not considered to be in short supply. Open, bare-soil areas, flooded by spring rains are, at this point, considered to provide ample habitat. Northward migration occurs from March to mid-May. Southbound migration starts in early July, peaks August through September, and tapers off toward winter, usually lasting until at least the end of October. The lack of shallow-flooded or mud-flat habitats in late summer and fall results in a severe shorebird habitat shortage.

Managing moist soil for both waterfowl and shorebirds is possible if managers have adequate water level management capabilities that enable them to draw down and flood impoundments at critical times. The Complex has focused shorebird management efforts on the Cox Ponds at Yazoo NWR. Research demonstrates the success of these habitats for both waterfowl and shorebirds. The biological review team identified additional opportunities for shorebird habitat management on former catfish ponds at Morgan Brake NWR.

To support a tentative population objective of 500,000 shorebirds during southbound migration, an objective of 1,500 acres of strategically located shallow-water and mud-flat habitat has been identified as a target for the entire State of Mississippi. The migration figure is based on some tentative assumptions, and experts believe that the objective may need to be as much as twice that estimate.

Colonial Waterbirds/Wading Birds

The Complex supports 20 species of colonial waterbirds/wading birds. Of these, 65 percent breed on refuge lands. Various sites on Yazoo, Hillside, and Morgan Brake NWRs have been used as rookeries. High priority species include the federally listed least tern, breeding white ibis, and wintering American white pelican. The least tern has been known to forage on open waters on Yazoo and Morgan Brake NWRs. White Ibis use the Cox Ponds extensively for foraging throughout the breeding and post-breeding periods and even through the winter in warm years. Although white ibis do not nest in any refuge rookeries, the largest white ibis rookery known to occur in Mississippi is located on private lands in the White's Lane rookery adjacent to Panther Swamp NWR within that refuge's acquisition boundary.

Birds of local or regional interest include the wood stork, roseate spoonbill, glossy ibis, double-crested cormorant, anhinga, great blue heron, great egret, snowy egret, little blue heron, cattle egret, green heron, black-crowned night heron, and yellow-crowned night heron. Each of these species (except the wood stork, roseate spoonbill, and glossy ibis) nests or has nested in recent years on the Complex.

Concern has arisen recently about the double-crested cormorant nesting in the Swan Lake rookery on Yazoo NWR and in the White's Lane rookery adjacent to Panther Swamp NWR. Rapid proliferation of nesting pairs, fueled involuntarily by the artificial habitat of the aquaculture industry, causes concern that cormorant numbers may build rapidly, displacing other species in rookery habitat.

In addition to the preservation of appropriate vegetation, water levels must be maintained during the nesting season and the rookery area protected from extensive disturbance. Rookery die-offs in 1990 and 1991 were attributed to deliberate aerial spraying. There may not be a serious likelihood that such an incident will recur (grand jury investigations were conducted on the last incident). However, rookeries are still vulnerable to unintentional aerial spraying and drifts from chemicals used on crops.

HABITATS

Bottomland Hardwood Management and Restoration. The Complex is situated within the physiographic region known as the Lower Mississippi River Alluvial Valley (LMRAV). The LMRAV was historically a 25-million-acre forested wetland complex that extended along both sides of the Mississippi River from southern Illinois to southeastern Louisiana. The extent and duration of flooding from the Mississippi River fluctuated annually and served to recharge aquatic systems, creating rich, dynamic habitats that supported diverse fish and wildlife resources.

As civilization pushed westward, the highest, least flood prone lands were cleared and converted to rich farmland. With success in agriculture and an expanding human population, more land was cleared and additional flood control measures were implemented. Today, the LMRAV is criss-crossed by levees and a myriad of flood control projects supporting less than 5 million acres of mostly fragmented bottomland hardwood forests. Declines in the fish and wildlife resources have mirrored the decline of the forest.

Although reforestation is an obvious solution to replace the forests converted to row-crop agriculture, reforestation would restore only one component of the landscape. In addition to reforestation, restoring or mimicking the historic hydrologic cycle is needed because flooding drives the ecological system in the LMRAV.

Recently, reforestation has been identified as a method for removing carbon dioxide (the principal greenhouse gas) from the atmosphere. Reforestation can help offset greenhouse gas production by storing carbon dioxide in vegetation biomass. To date, a total of 20,837 acres have been reforested on lands in the Complex, including 5,796 acres of COE lands and 8,669 acres of Farm Service Agency lands. Reforestation projects help restore habitat for forest species, decrease forest fragmentation, and help establish larger "core" forest areas that are valuable for interior forest-dependent species. However, little is known about restoring and managing reforested bottomland hardwood habitats.

Little to no historical information is available on how forests were structured prior to European settlement. Studies have begun only recently to address management after restoration. Initial reforestation efforts considered that any tree planting was good, no matter where the trees were planted. Recent evidence has shown that some of the smaller, isolated reforested lands, such as Farmers Home Administration properties, perpetuate the hostile "edge" effect for some species. These smaller reforested sites provide little habitat for neotropical migratory species of special concern, and in retrospect, maintaining some of these areas in a scrub/shrub habitat would possibly have better benefited priority bird species.

Because natural succession in reforested areas does not produce the preferred habitat rapidly, timber harvest is used to increase diversity and the desired forest composition. Commercial harvests have been a valuable (and often the only) tool for managing existing hardwood stands. Scheduled harvests are essential to maintaining a healthy forest that is diverse and provides structure and desirable tree species. Future opportunities to reforest lands will be available as row crop agriculture is reduced on the Complex, and additional agricultural lands within the acquisition boundaries are purchased.

Agricultural Crops for Waterfowl. To support the specific waterfowl objectives set for each refuge, farming operations are conducted on all refuges in the Complex except Mathews Brake NWR. Agricultural crops provide cover and high calorie "hot foods" to supplement natural foods. In addition, farming is used to set back succession and control weeds in moist-soil units.

All farming operations are conducted cooperatively in a mutually beneficial manner by local farmers. Cooperative farming has long been an accepted, efficient, and necessary method of producing crops for waterfowl foods. Cooperative farmers are allowed to farm refuge land under certain guidelines and restrictions, including crop location, tilling techniques, crops planted, and chemicals used. In return for providing the land, the refuge receives a share, usually 20 - 25 percent of the crop.

Depending on waterfowl needs, the refuge's share of the crops may be left in the field to provide immediate food and cover, or may be harvested and stored for later use. Title 50, Part 29, of the Code of Federal Regulations, and Service policies require that the value of a refuge's share of cooperatively grown crops be set at rates that reflect the fees and charges received by private landowners in the vicinity for similar privileges. The value can be established through the use of competition in selecting cooperators or through an analysis of local market conditions to establish the prevailing rates in the nearest comparable area.

Approximately 9,600 acres of refuge lands in the Complex are farmed by seven cooperative farmers. Under the current cooperative farm program guidelines for crop sharing and rotation, this amount of production is needed to meet the current minimum objective for the Complex. The optimum farm-acre objective has not been determined, but will be decided in conjunction with the LMVJV step-down plans. The LMVJV is reevaluating unharvested crop objectives on refuges. New studies on the value of harvested agricultural crops on private lands indicate that earlier harvest dates and more efficient harvest techniques significantly reduce the waste grain available for wintering waterfowl. Based on this new information, unharvested crop objectives on refuge lands may increase. These acres include leveled farmland, as well as impoundments that have yet to be rehabilitated to allow for active moist-soil management. In the early 1980s and again in 1994, cropland management plans were developed that identified the need to ensure all farming operations followed best management practices (BMPs). Improved methods and chemicals will provide more opportunity to meet BMPs. A brief description of current farming practices and the benefits of implementing some of these BMPs, follow.

Buffer Strips. Buffer strips up to 200 feet wide were established along most refuge fields in the early 1980s as part of a BMP project to create habitat (ecotone strips), reduce erosion from agricultural fields, and provide a transition between open fields and open woods. Over the years, these areas have been planted to trees or allowed to undergo natural succession, compromising some of the benefits intended by BMPs. Although unpopular with cooperative farmers because the buffer strips removed lands from crop production and reduced potential yields and profits, the strips provided valuable habitat for small mammals, birds, etc. In addition to wildlife habitat and water quality, these conservation buffers also provided myriad other benefits including:

- Slowing water runoff;
- Trapping sediment and enhancing infiltration within the buffer;
- Trapping fertilizers, pesticides, pathogens, and heavy metals;
- Reducing soil erosion in areas with strong winds;
- Stabilizing streams and reducing their water temperatures;
- Offering a setback distance for agricultural chemical use from water sources;
- Providing a source of food, nesting cover, and shelter for many wildlife species;
- Acting as mini corridors that enable wildlife to move safely from one habitat area to another; and
- Providing habitat for small mammals which also serve as prey for raptors.

The step-down plan will be updated to address current BMP needs and opportunities.

Burning Wheat. No-till farming in harvested wheat fields is the preferred farming method and continues to be encouraged, but weed infestations, limited approved chemical use on the refuge, and high chemical costs have reduced the extent of this practice. To reduce production and chemical costs, cooperative farmers have been permitted to burn wheat stubble. Historically, these burns were 200 acres or less and were set and managed by the farmer. Today, trained refuge staff members conduct all the prescribed burns. Burning is the easiest means to clear a field for planting and eliminates the need of mechanically disking crop residues, usually resulting in a higher profit for the farmer. While it is the most economical method, burning, like disking, may cause impacts to the area including exposing the unprotected soil to erosive effects of wind and water. Smoke from burning crop residues may cause a smoke nuisance or health and safety hazards. Also, tests have shown that only portions of the nutrients in crop residues are returned to the soil by burning; the rest (primarily nitrogen) are lost into the air (D. Westover, University of Nebraska 1984). When the stubble is turned under by disking or is left in place, these nutrients are not lost. However, disking results in soil moisture loss and delayed planting because disked areas require a rain event before planting.

Water Furrows. Farmers use water furrows to drain water from depressions in the fields, allowing the soil to dry more quickly and evenly, which also allows earlier planting. Heavy rains cause run-off of silt-laden waters, which carry eroded topsoil. If not filtered through grassy waterways or buffer strips, these silt-laden waters enter wetlands. Crops planted earlier in the season are less susceptible to moisture shortages and pest problems, therefore requiring fewer chemicals. To minimize the introduction of silt-laden waters into wetlands and streams, water furrows on refuge cooperative farmland will be filtered through grassy waterways or buffer strips.

Disking. Fall disking is permitted on some agricultural lands in the Complex to facilitate early corn planting. Early planting reduces chemical uses and early rains provide sufficient moisture for the corn. The Complex requires some type of cover be planted on these disked fields to provide cover for wildlife, and to reduce erosion from wind and water.

Force Account Farming. Cooperative farming has been a long-standing practice throughout the refuge system nationwide, and is a mutually beneficial program. However, due to more restrictive regulations regarding approved chemicals, agricultural burning, and the encouraged use of BMPs, it is becoming more challenging to find farmers who are willing to alter their familiar farming techniques to meet refuge requirements. In addition, the steady decline in crop prices over the previous few years has reduced the cooperative farmer's profit margin. As restrictions increase, the number of willing cooperative farmers will diminish due to hardship and profit loss. Therefore, the use of cooperative farming to achieve waterfowl objectives may not be a management option in the future.

If Service resources were used to replace cooperative farming, a significant increase in funding would be necessary for initial start-up costs and annual farming efforts. The cooperative farmer's objective is to grow crops that produce maximum yields. Refuge farming efforts would focus on supplementing food sources for migratory waterfowl. Therefore, chemical use to control weeds and insects would be reduced. Force account farming would allow a reduction in the number of acres farmed. However, additional staff and equipment would be needed to farm refuge lands to meet the stated objectives, and it is unlikely that these resources could be obtained.

Acres that could be flooded and those used historically by Canada and white-fronted geese would rank highest to farm. A portion of the lands removed from agriculture would be converted to early successional habitats such as grassland, scrub/shrub, and moist-soil because reforesting these lands would not contribute to interior forest objectives. If needed, early successional habitat could be converted back to agricultural production.

Moist-Soil Management. The LMVJV has established moist-soil objectives for the Complex to support the North American Waterfowl Management Plan. Moist-soil management refers to management that promotes moist-soil conditions to encourage the natural production of beneficial plants. Seeds and plant parts produced by these plants often attract and concentrate waterfowl and other wetland wildlife species. The decomposing vegetative parts of moist-soil plants also provide substrata for invertebrates, which are vital foods for many wetland wildlife species. Factors that determine the success of moist-soil management include the timing and rate of drawdowns, soil disturbance and the stages of plant succession, and the timing and rate of re-flooding. Best success is achieved when water levels can be controlled, although good results can be obtained under natural conditions when artificial draining and flooding are not possible (1995-2002 Conservation Commission of Missouri).

Waterfowl depend on nutrient rich seeds and invertebrates for various parts of their lifecycles. While high-calorie agricultural crops (hot foods) provide the needed energy for wintering migratory waterfowl, it is equally important that waterfowl receive the nutrients needed to remain healthy and to reproduce. Natural wetlands such as moist soil are best utilized when in close proximity to "hot foods" to facilitate waterfowl access to aquatic invertebrates and other natural foods that are comparatively scarce in croplands (Biological Review Report, Rick Kaminski 2001).

While the Complex has areas identified as "moist soil," not all areas have full water management capability. A lack of water management capability limits the production of maximum desirable foods while controlling undesirable plants. An analysis of the Complex's current acreage and management of moist-soil areas is needed to determine how to best meet the objective, and to develop funding and staffing strategies to maximize management of these areas. Particular attention should be given to proper record-keeping on water level management and subsequent plant and waterbird responses.

Aquatic Habitat Management. On Yazoo NWR, Steele Bayou flows along the north and east side of the refuge. The COE has channelized and dredged Steele Bayou, and used the spoil material to construct a levee. The levee separates the water in Steele Bayou from Swan Lake, the refuge's largest body of water. The levee is designed to divert floodwaters (and pesticide laden silt) around Swan Lake. However, the material on which the levee lanes are constructed is not suitable and the levee has failed in some areas. As a result, the COE has not completed the Steele Bayou Channelization project, and is currently studying plans to relocate a portion of the channel to an area with soils that are more suitable and where a firmer foundation is available.

The largest body of water on Yazoo NWR is Swan Lake, which the COE has divided into four management compartments. Swan Lake is bounded on the east side by Steele Bayou and contains mostly water-adapted trees (bald cypress, willow, water elm, ash, swamp privet) and shrubs (buttonbush) interspersed with open water. The Compartments are numbered beginning with #1 on the southeast side of Swan Lake. Compartment #1 is separated hydrologically from the other three compartments and contains relatively higher ground. Compartment #1 is managed as a greentree reservoir (GTR). Compartment #2 is flooded by rainfall and runoff in the fall and winter and drained in the spring to allow moist-soil plant growth and to protect important mast trees around its edge (Nuttall oak) that are less adapted to flooding. Pipe-arch structures allow water to flow into Swan Lake Compartments #3 and #4 from Silver Lake Bayou on the north end of the lake. The structures are opened in the fall when silt loads are low in the bayou. Compartment #4 is the largest and deepest compartment, and is maintained as a permanent swamp. Compartment #4 contains a large colonial waterbird rookery.

The segment of Steele Bayou within the refuge boundary is controlled by the COE at a weir downstream from the refuge. Weir E, located at the mouth of Silver Lake Bayou on the north end of the refuge, controls water levels in Silver Lake Bayou. Weir E is manipulated by refuge personnel for habitat management purposes and to reduce flooding impacts to private lands upstream. A controversy (from private landowners) over the elevation of the weir shortly after construction resulted in the removal of a 1-foot elevation of concrete from the weir. As a result, water levels upstream of the weir do not provide adequate flow into Swan Lake for habitat management.

In the central interior area of Yazoo NWR, Deer Lake is an area of permanent water containing marsh habitat with giant cutgrass in shallower areas. Several species of marsh birds use it for nesting and brood-rearing. Deer Lake is relatively shallow (<6 feet) and subject to lotus overgrowth. Refuge personnel treat the lake with glyphosate periodically to reduce the American lotus. Deer Lake historically has produced the greatest numbers of wood ducks compared to other habitats on the refuge, possibly due to the greater number of wood duck nest boxes in the lake and the habitat that it provides.

Alligator Pond is an area of permanent water located on the southwest side of Yazoo NWR. This area is also a productive wood duck nesting site, is subject to overgrowth of American lotus, and glyphosate is applied periodically. Water levels are raised in the winter to flood the surrounding hardwoods (as in a GTR). The majority of remaining permanent-water impoundments, such as Beargarden Lake, Lizard Lake, and Big Lake, are also managed to produce a GTR in the surrounding backwater areas during winter.

On Panther Swamp NWR, a water control structure in Deep Bayou controls a major portion of the east side drainage. During the winter, water levels are raised to flood brakes and forested areas. In the spring, water is released to protect bottomland hardwoods. A rapid release of water is desirable to discourage beaver activity and to prevent silt buildup. A deterrent to the rapid release of water is the fixed-level COE weir which is located downstream in the Landside Ditch. The purpose of the weir

is to hold water, which controls vegetation in the Landside Ditch. The Landside Ditch drains the entire east side of the refuge. The Landside Ditch weir slows water flows, which allows silt build-up in refuge drainage/waterways. The silt build-up makes it easier for beavers to build dams, causing increased expenditures of time and effort for dam removal, resulting in the loss of mature bottomland hardwoods.

Mathews Brake NWR includes a 1,810- acre oxbow lake with ridge-and-swale topography. Deeper water areas contain baldcypress and water tupelo, and higher elevations contain bottomland hardwoods. Portions of the lake are in private ownership. Historically, water flowed into the southeast corner of Mathews Brake via a tributary of Abiaca Creek. During periods of normal water levels in the Abiaca tributary, water was allowed to pass through a 40-inch pipe under a road. To prevent the brake from completely drying up during the hot summer months, refuge staff diverted water into the brake through the 40-inch pipe starting in June. By the beginning of duck season, rains and continued water diversions filled the brake to the desired level. After heavy rains, when the stream carried a substantial silt burden, the pipe was closed. A significant rain event early in 2003 dislodged the pipe and incoming flows filled up the channel with sand and silt, effectively preventing the inflow of water to the brake. In late 2004, a new channel was constructed from a tributary of Abiaca Creek to the brake to provide a reliable source of water. Water levels in the brake are controlled by two water control structures at the head of the channel.

VISITOR SERVICES

Priority Public Uses

The National Wildlife Refuge System Improvement Act of 1997 established six priority public uses on refuge lands when they are compatible with the defined purpose(s) of that refuge. The priority uses are hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation. Historically, the Complex's visitor services program focused on traditional recreational uses, primarily hunting and fishing. Figures 11-15 depict current visitor services at refuges within the Complex. This CCP will address opportunities to expand visitor services to encompass non-consumptive uses, such as wildlife observation, wildlife photography, and environmental education and interpretation. With adequate staff and funding, a variety of public uses can be developed for refuge visitors.

Figure 11. Yazoo National Wildlife Refuge current visitor services

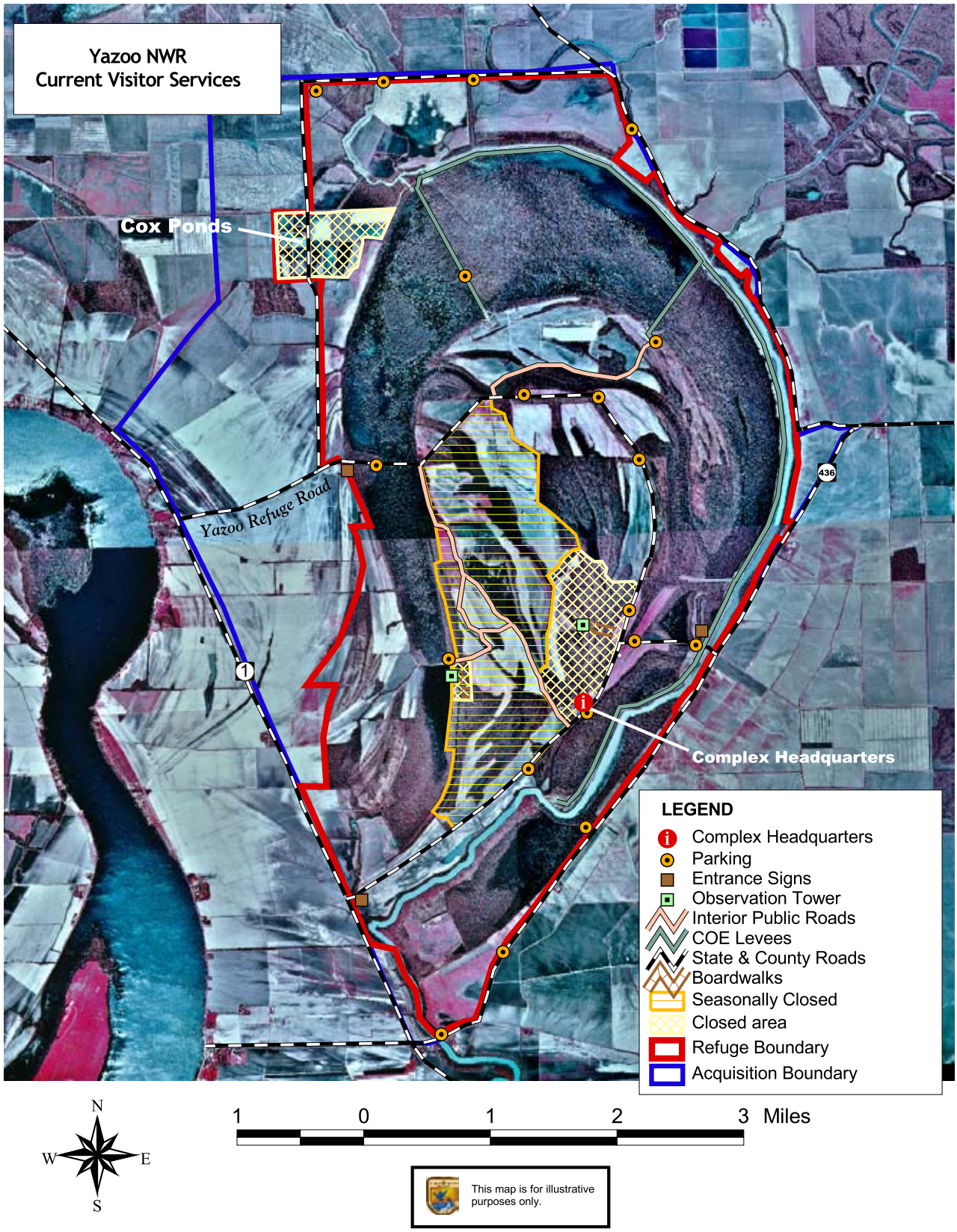


Figure 12. Panther Swamp National Wildlife Refuge current visitor services

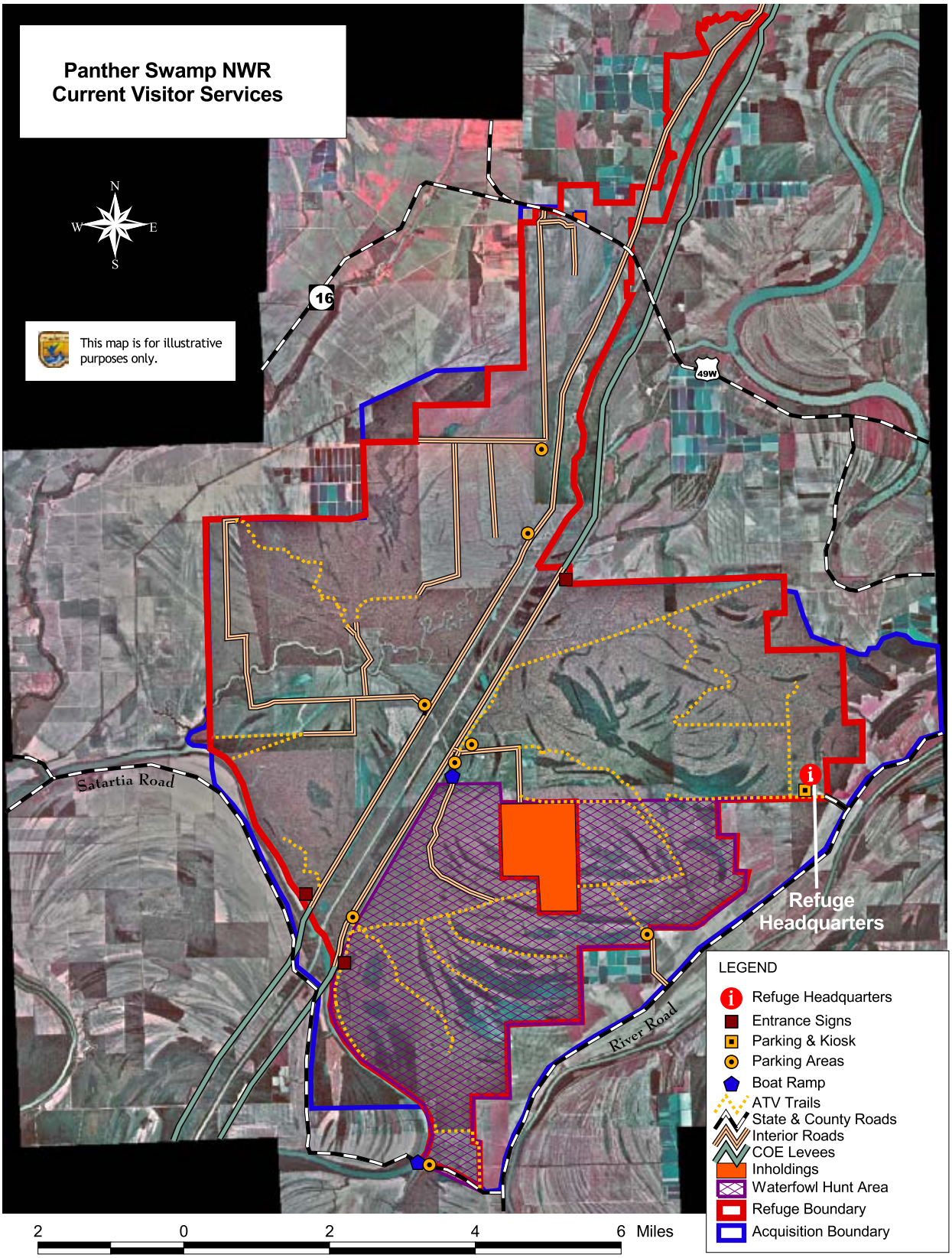


Figure 13. Hillside National Wildlife Refuge current visitor services.

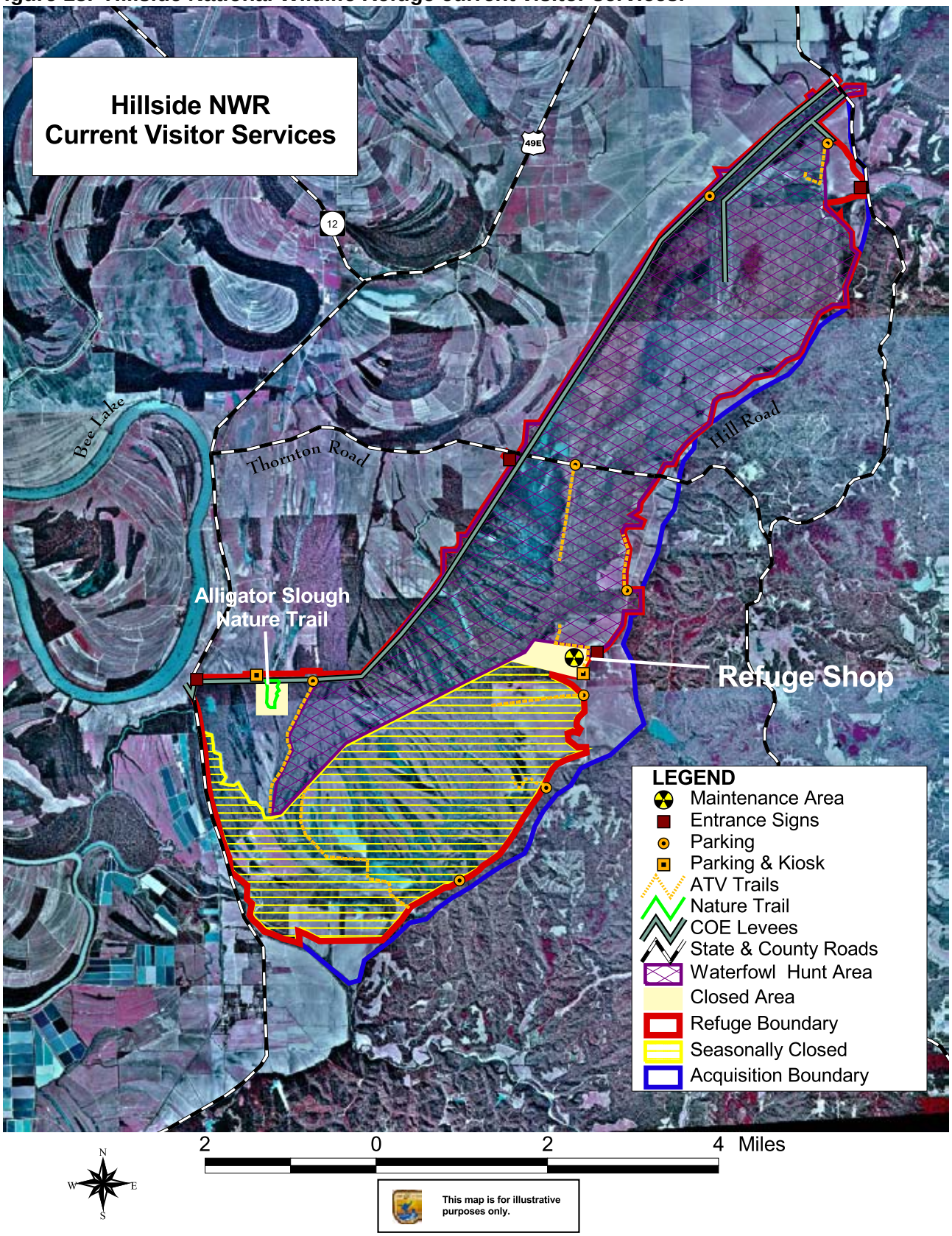


Figure 14. Morgan Brake National Wildlife Refuge current visitor services.

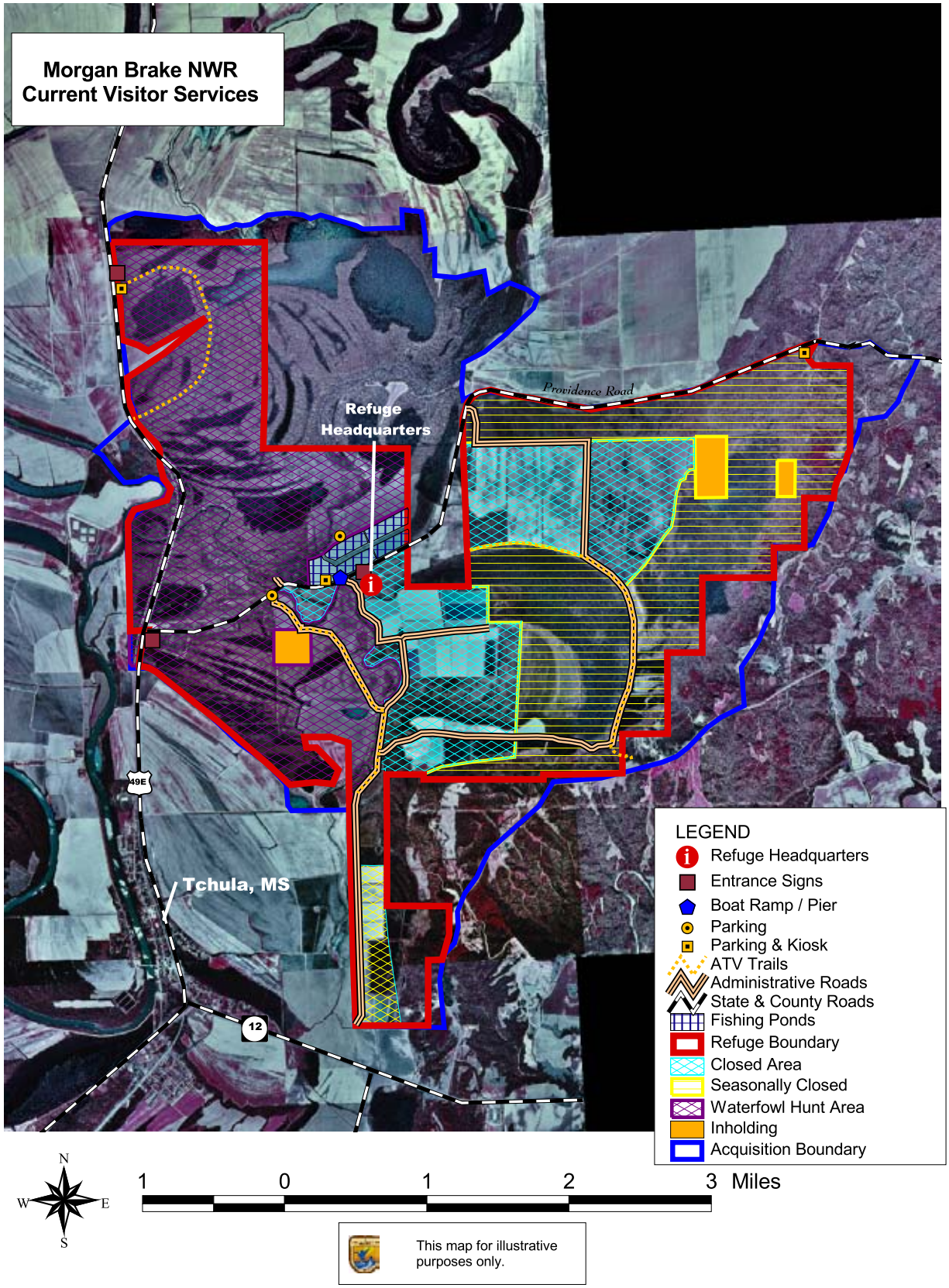
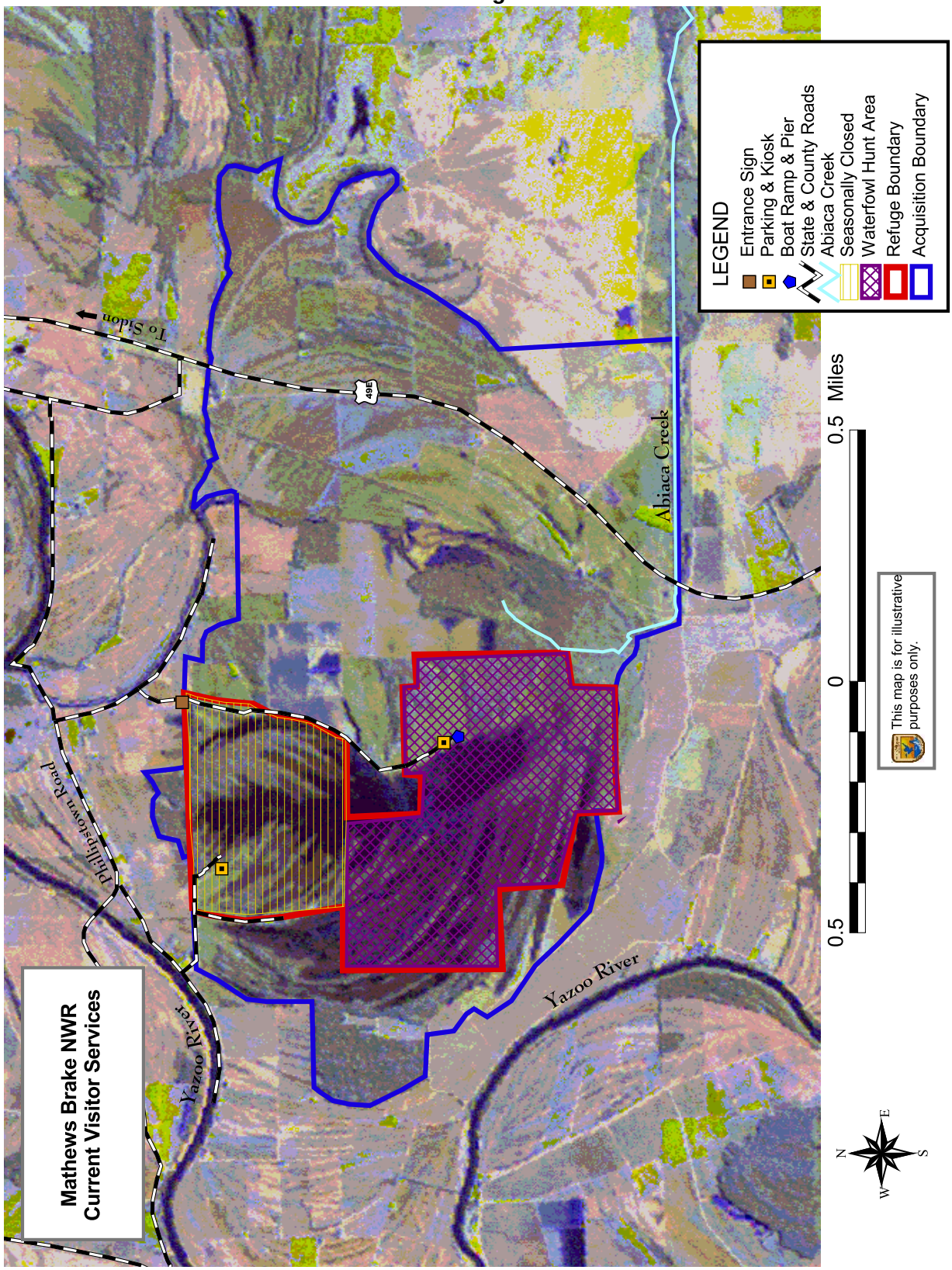


Figure 15. Mathews Brake National Wildlife Refuge current visitor services



Hunting. Managing wildlife populations and their habitats is a primary responsibility of the Complex and a required component of the Service's "wildlife first" mission. If managed appropriately, hunting provides a biologically sound form of outdoor recreation that is used extensively throughout the Refuge System to manage wildlife populations. The 1997 Refuge Improvement Act, other laws, and Fish and Wildlife Service policy permits hunting on refuges when it is compatible with the purposes for which the refuge was established. The Complex hunting program is coordinated annually with the MDWFP, and hunting activities are managed so as not to cause disturbance to migratory waterfowl in sanctuary areas.

Hunting accounts for more than 90 percent of refuge visitation (of the approximately 160,000 visitors each year), and the Complex's hunting programs provide the public with 1,363 days of hunting per year (Table 10). The Complex is well-known throughout the surrounding area and adjacent states for high quality deer and duck hunting opportunities. Hunting programs are also offered for small game (squirrel, rabbits, raccoon), dove, wild turkey, and bobwhite.

Table 10. Number of "hunt days" by refuge and species or group, 2004

Refuge	White-tailed deer	Turkey	Waterfowl	Small Game	Total
Yazoo	75	0	0	66	141
Panther Swamp	114	44	43	129	330
Morgan Brake	106	0	48	125	279
Hillside	106	0	48	125	279
Mathews Brake	123	0	60	151	334
Total	**524**	**44**	**199**	**596**	**1,363**

From October 1 to the end of February each year, a large percentage of the staff's time is devoted to managing the hunt program. The Complex employs one full-time office clerk who devotes 100 percent of her time to processing and issuing special use permits for general hunting, fishing, and quota hunt permits. The office clerk also responds to telephone and visitor inquiries and manages the computerized hunt draw program. From October 1 to mid-November, the office clerk works about 30 hours of overtime per pay period to complete the necessary work to support the special use permit program and other duties assigned to the position (e.g., computer updating and website management). In the 2003/2004 hunting season, 6,089 unlimited and 1,522 limited/lottery permits were sold to hunters and anglers, generating nearly $92,308.

From October 1 to the end of February, law enforcement staff patrol and conduct surveillance, check hunter permits, operate deer check stations, respond to hunter emergencies, enforce laws and regulations, ensure public safety, and protect refuge resources. In the 2003/2004 hunting season, the Complex employed nine law enforcement officers (1 full-time, 4 dual function, and 4 seasonal officers) to accomplish this work on five refuges and 43 Farm Service Agency tracts. The dual function law enforcement officers devoted 100 percent of their time to law enforcement duties during the hunting season, worked additional hours beyond their scheduled shifts, and managed or maintained refuge resources the remaining six months of the year in the following positions: refuge managers, biological science technicians, and equipment operators.

Law enforcement officers typically handle approximately 4,600 incidents or violations each year, including incidents associated with vandalism, suspicious persons reports, weapons violations, and natural resource violations. Refuge law enforcement officers also respond to requests for assistance to locate lost hunters or anglers, accidents, periodic flooding events that cover roads and traps visitors, and violations involving Farm Service Agency lands.

Between 2003 and 2004, the Complex lost 5 law enforcement officers to employee resignations and Service policy changes. Two full-time dual function law enforcement officers/biological science technicians resigned; one full-time dual function Law Enforcement Officer/Project Leader relinquished law enforcement authority due to Service policy changes; and two seasonal temporary law enforcement employees and one full-time dual function officer were lost due to new Service policy changes on refuge law enforcement. Subsequently, in 2004, the Complex employed only one full-time and three dual-function law enforcement officers to cover the same work nine officers performed in 2003. The full-time law enforcement officer devotes 100 percent of his time to law enforcement. During the 6-month-long hunting season, the dual function law enforcement officers devote 100 percent of their scheduled shifts to law enforcement, plus an additional 40 hours per pay period beyond their shifts' limits during peak hunting periods.

Two of the five lost officers were biological science technicians who conducted refuge maintenance and resource management duties during non-hunting season. The loss of these employees has severely hampered law enforcement capability during the hunting season, and reduced the Complex's ability to conduct refuge maintenance and habitat management during the remainder of the year.

At public scoping meetings, more than 90 percent of the comments were related to hunting. Some of the identified issues included hunter overcrowding, public safety, a lack of law enforcement presence, declining deer harvest on Panther Swamp NWR, a lack of upland game bird hunting, all-terrain vehicle use, expanded waterfowl hunting, disabled and youth hunts, and others. Most of the identified issues directly affect the Complex's responsibility for maintaining healthy wildlife populations and meeting refuge purposes, while providing visitors with a high quality and safe hunting experience.

One of the important issues discussed at the public meetings was hunter overcrowding on Mathews Brake NWR during the duck hunting season. Mathews Brake NWR provides 60 days of waterfowl hunting. There is no current restriction on the number of hunters who can use this small area. Recent articles in outdoor magazines have identified Mathews Brake NWR as a premier waterfowl hunting area. While this coverage is favorable, the notoriety created by the articles has increased visits by larger numbers of local and out-of-state hunters, greatly reducing the quality and safety of the hunt.

White-tailed deer hunting is a popular activity throughout the region, and the Complex has a reputation for providing outstanding deer hunting opportunities. The Complex offers 524 days of white-tailed deer hunting. Because four of the five refuges in the Complex were established for migratory birds, deer populations must be controlled to prevent adverse impacts to migratory bird habitat. Harvest and habitat data collected over the years have clearly demonstrated the need to remove approximately one third of the deer annually in order to maintain a healthy herd and to prevent habitat damage. In the absence of large predators, such as wolves or cougars, deer populations can rapidly increase and destroy migratory bird habitat. Deer consume agricultural crops planted as high calorie foods for wintering waterfowl and browse the understory vegetation in forested areas, preventing tree regeneration and altering the structure and species (flora and fauna) composition of the forest. Over-browsed habitat cannot provide food or cover for scrub/shrub-dependent species, and habitat for birds is reduced when deer consume vegetation used for cover or nesting.

Yazoo NWR produces approximately 200 deer a year which exceed healthy population maintenance (Yazoo NWR data files). As deer herds radically reduce their food resources, they can starve or become susceptible to diseases that healthy deer do not contract under normal circumstances. A lack of sufficient food on refuge lands would force deer to move beyond refuge boundaries onto adjacent private lands where they can consume agricultural crops planted by refuge neighbors. Allowing hunters to remove surplus deer reduces the potential for refuge habitat damage and agricultural crop losses, and negates the expense of controlling the deer herd with refuge employees.

The Complex's deer population management program is dependent upon the availability of a sufficient number of hunters to reduce the deer population to below carrying capacity. During normal reproductive years, the refuge's objective would be to remove approximately 33 percent of the deer population. On refuges in the Mississippi Delta region where deer are abundant and reproduction success is high, refuges are challenged to attract a sufficient number of hunters to reduce the population to the targeted level. Typical deer do not provide an incentive to the hunting public because hunters can take typical deer at a variety of hunting areas throughout the Delta. To draw hunters to refuges for deer hunting, an element must be added that is not available to the average hunter elsewhere in the Delta. Historically this has been accomplished by providing the expectation that a trophy buck can be harvested from refuge lands.

To ensure that migratory bird habitat is not adversely affected by deer populations, annual public deer hunting opportunities will be offered. The program will aim for removal of approximately one-third of the herd annually with a 1:1 harvest ratio of the sexes. The regulation of season lengths, hunting areas, and hunter quotas will ensure a balance between population levels and carrying capacity, while providing for public safety during hunting season. The Complex's hunt program is designed to optimize the number of deer taken while maintaining a percentage of older bucks (5 to 10 percent) in the trophy class each year to attract enough hunters to reduce the herd by 33 percent. To date, Complex efforts have attracted sufficient hunters to remove the desired number of deer, as evidenced by the presence of hunters from 26 states during the 2003 hunt year.

Hunting is also offered for other small game from populations of animals capable of sustaining harvest, including ducks, rabbit, squirrel, raccoon, and quail. These hunting programs are very popular and contribute to the Complex’s public use program.

*Fishing***.** Currently, fishing is the second most popular public use activity on the Complex. All refuges within the Complex, with the exception of Yazoo NWR, are currently open to fishing at certain periods throughout the year. The closure of Yazoo NWR to fishing is based upon the presence of high organochlorine levels, including DDT, in fish on the refuge. These levels have exceeded minimum federal standards.

The 1997 Fisheries and Aquatic Resources Strategic Plan (1997 Fisheries Strategic Plan) recognizes the importance of fisheries and aquatic resource management and identifies goals to meet fisheries needs. Goal 5 directs the Service to “Provide for sustainable recreational fishing opportunities in the Southeast adequate to meet public needs.” An objective under this goal states, “Provide and maintain recreational fishing opportunities on Service lands” and lists several tasks in conjunction with this pursuit, including “establish new recreational fishing opportunities,” “increase access to recreational fishing sites on and across Service lands,” and “develop methods for integrated management of migratory bird populations, other animals and plants, and recreational fisheries on Service lands.”

Challenges associated with meeting the goals of the 1997 Fisheries Strategic Plan include local water quality issues, such as sedimentation, contaminants, channelization, and agricultural impacts. Most streams or rivers in the Complex have been channelized or altered, and open-water aquatic sites on the refuges that are suitable for fishing are predominantly commercial catfish ponds that have been acquired and modified. These issues hinder the ability of the Complex to meet the goals of the 1997 Fisheries Strategic Plan. In addition, barriers to the natural migration of desirable game fish into refuge waters due to hydrological alterations have resulted in a higher proportion of "rough fish," such as carp, in refuge waters.

Secondary challenges to meeting the goals of the 1997 Fisheries Strategic Plan include:

- The lack of public access to fishable waters (e.g., roads, trails, and boat ramps).
- The lack of fishing facilities that would enable public fishing (e.g., docks and fishing piers).
- Providing angler access while minimizing disturbance to waterfowl, shorebirds, and other waterbirds.
- Meeting habitat objectives for waterbirds while incorporating fisheries management into the same impoundments.

Roads and Trails, Interior and Exterior

Federal, state, or county highways and COE levee roads currently provide access. Many interior roads were constructed to facilitate farming and timber-harvest programs. Some roads provide all weather access with a minimum clearance 2-wheel drive vehicle. However, many roads on the refuges are impassible to 2-wheel-drive vehicles during wet weather and some roads are impassible to 4-wheel drive vehicles during wet weather.

Road maintenance is expensive, time-consuming, and in some areas on a few refuges only possible in late summer during the driest conditions. The staff devotes a large portion of its time to road maintenance (e.g., grading, mowing, and spraying), particularly on Panther Swamp NWR where local soils are not suitable substrate for roads. Often even minimal traffic produces ruts and potholes that preclude subsequent vehicle access. The lack of public access by conventional vehicles to large portions of the refuges has been addressed somewhat by the use of all-terrain vehicles (ATVs).

Studies have shown that excessive off-trail ATV use has a detrimental effect on habitats. Impacts can include soil erosion, natural water flow alterations, the destruction of plant root systems, the spread of exotic and invasive plants, noise, and air pollution. However, access to some portions of the refuges is not available without ATVs. Per capita, there are more ATVs sold in Mississippi than any state in the nation, primarily due to their ability to provide access to remote areas that are inaccessible by car or truck. As larger and more powerful ATVs are designed, more passengers can be carried, and a larger footprint of impact is produced.

Panther Swamp NWR currently offers 38 miles of ATV trails, Hillside NWR offers 9 miles, and Morgan Brake NWR offers 8 miles of trails, for a combined total of 55 miles. All trails are well defined on hunt brochure maps and are open only during periods of hunting and fishing. Trails are difficult, time consuming, and expensive to maintain. The ATV trails on Panther Swamp NWR are the most difficult to maintain. When ATV operators cannot navigate an impassible portion of the trail, they often drive off-trail through the forest, damaging habitat as they proceed. Larger ATVs produce more damage then lighter ATVs and with heavy use and abundant rainfall, the wet, poorly drained soils become heavily rutted. During the winter season and after rain events many ATV trails function as waterways, eroding soil along the way and increasing sedimentation in the forests and other types of habitats.

Two executive orders regulate ATV use on federal public lands: Executive Order 11644 signed by President Nixon in 1972, and Executive Order 11989 signed by President Carter in 1977. Together these orders require that off-road-vehicle use on public lands must be managed to "protect the resources of those lands, to promote the safety of all users of those lands, and to minimize conflicts among the various uses of those lands." The orders also require that when ATV routes are designated, federal land managers must minimize damage to soils, watershed, vegetation, and other land resources, minimize wildlife harassment and impacts to wildlife habitat and minimize conflicts between ATV use and other uses of the land. In compliance with these executive orders, Service policy requires all ATV use to be in conjunction with wildlife-dependent activities only, and ATV use is confined to designated areas or trails.

Public comments on the value of ATVs were mixed, centering mainly on two factors: the desired use of ATVs to access remote hunting areas and to retrieve harvested deer, and the opposition to ATV use due to the impacts and disturbance they produce. With the currently accepted use of ATVs and the public's perception that ATVs are a necessity to access hunting and fishing areas, it would be difficult to develop an effective public use program that provides maximum area use for hunting and fishing opportunities without providing for some limited ATV use. One of the most popular activities on the Complex is deer hunting, and in order to obtain the targeted harvest level of white-tailed deer, it is necessary to disperse hunters over as much of the Complex as possible. A wide dispersal of hunters also reduces problems associated with hunter overcrowding along roads that remain accessible throughout most of the year.

These factors combined can produce challenges that restrict public access and prevent hunter dispersal. One potential solution for several of these factors would be to acquire county road access along the outside perimeter of all of the refuges (subject to the availability of willing sellers.)

Visitor Centers and Contact Stations. No visitor center is available on any of the refuges in the Complex. The Complex currently maintains only three offices, the Complex headquarters at Yazoo NWR, the refuge office at Panther Swamp NWR, and the refuge office at Morgan Brake NWR. Two of the office facilities, including the Complex headquarters located at Yazoo NWR, and the refuge office at Panther Swamp NWR, are very inadequate for staff and visitor needs. Both the biological and public use review reports recognized the need to construct new facilities in order to provide opportunities for program development and to properly welcome and orient visitors. A small office is located in the shop at Hillside NWR, but this refuge is unstaffed. Mathews Brake NWR has no office and is also unstaffed.

The headquarters at Yazoo NWR was built in 1959 as a shop/office and has been modified over the years to accommodate a growing staff. The shop bays have been converted to offices, and the building now contains offices for 8 staff members. Office spaces are cramped and outdated, and storage areas for files and other refuge documents are very limited. A gravel drive and parking lot introduces gravel dust into the office that settles into keyboards, computers, printers, and other office electronic equipment. The building contains one small room that provides space for both visitor reception and office space for two staff members. Only a single-unit restroom is available for the staff, and it is often shared with visitors.

The headquarters office water supply is a well-water treatment system and 900-gallon holding tank that was installed in 2001. Drinking water in the headquarters office is available only from the restroom sink, or from an outside water spigot at the side of the building. The water supply system also supplies drinking water to two maintenance shops, two volunteer trailers, and two quarters' houses. No public drinking water or public restrooms are available to the public.

Although Yazoo NWR actually receives over 60,000 visitors annually, Refuge Management Information System (RMIS) data reports that the Complex headquarters office receives only about 11,000 visitors annually. These numbers demonstrate the difference between the abundance of visitors using the refuge and the much fewer numbers of visitors stopping by the headquarters office. The primary reason for the difference is due to the lack of drinking water, public restrooms, public use programs, interpretation information, and visitor services facilities at the headquarters office.

Morgan Brake NWR received funding for a new office in 2003. The refuge receives about 6,500 visitors annually. The refuge office was constructed in 2004 to replace the previous refuge office, a converted ranch-style house that was purchased as part of the land acquisition program and modified to serve as the refuge office. Funding was obtained for a new office after an inspection revealed extensive degrading asbestos materials in the converted ranch-style house. The new office will provide ample office space for the 4-5 person staff.

Panther Swamp NWR's office is also a converted ranch-style house that was originally constructed in the 1970s. In addition to structural issues associated with the concrete slab foundation, the wiring is outdated, the air conditioner and heater require frequent repair, and the septic system's capacity is very limited. In addition, the office has flooded several times in the past 10 years during significant flood events in the area.

Public Use on Farm Service Agency Fee Title Tracts. Forty-three widely scattered fee title Farm Service Agency tracts are included in the Complex, totaling over 12,000 acres. In January 2004, legislation sponsored by Senator Thad Cochran and Congressman Bennie Thompson created two new refuges in the Complex. No additional land was purchased to create the refuges. Instead, many of the existing Farm Service Agency fee title tracts were redesignated as the new Holt Collier and Theodore Roosevelt NWRs. Management plans for the two new refuges will be addressed in a separate CCP.

Of the 43 Farm Service Agency tracts (including those designated as the new refuges), 10 include public access and are large enough to provide quality, limited public hunting opportunities. Overall, the lack of adequate public access and poor quality of both interior and exterior roads has limited the amount of public use.

LAND PROTECTION

Contaminants and Sedimentation on the Complex

Complex refuges are surrounded by extensive agricultural row crop production, and contaminants and sedimentation from past agricultural practices have impacted every refuge in the Complex. Historical use of organochlorine pesticides (e.g., DDT, PCB's, toxaphene, dieldrine, and lindane), which contain heavy metals (mercury) were commonly used in farming operations (especially cotton) prior to being banned in the 1970s. These chemicals do not break down readily into harmless compounds and still remain in the substrate, attached to sediments that were deposited in waters within and surrounding the refuges. The chemicals continue to contaminate fish and other aquatic-dependent resources such as fish-eating birds, wood ducks, and raccoons. Birds feeding on contaminated fish ingest the chemicals or their bioproducts, and species feeding on the birds continue the bioaccumulation process. DDT and toxaphene levels found in sampled fish in Steele Bayou on Yazoo NWR have led to a prohibition on fishing in the Bayou on the refuge.

To provide sufficient water for managed water-dependent habitats, all of the refuges are dependent on water from the surrounding contaminated watersheds, streams, and rivers. Mathews Brake NWR receives water from Abiaca Creek, and Hillside NWR receives water from the Black and Fannegusha Creeks. Both of these creeks are listed on the state of Mississippi's Section 303(d) list of impaired waterbodies. Section 303(d) streams do not meet one or more of their designated uses because water quality in the streams is impaired. Water quality data collected by the Mississippi Department of Environmental Quality demonstrates that the water quality in these creeks has been impaired by high concentrations of fecal coliform bacteria. Water contaminated by intestinal bacteria could also contain salmonella, and there is concern that bacteria in stream water could overflow into wetlands in the area and cause diseases in waterfowl populations.

In addition to chemical and fecal coliform bacteria contamination, studies have shown that runoff from agricultural fields and upstream gravel mining operations have introduced excessive siltation and turbidity in waterbodies throughout the Complex. Studies conducted by the U.S. Geological Survey have shown that, overall, sedimentation has resulted in the loss of important wildlife (including migratory birds) and habitat, and has increased densities of undesirable fish populations (common carp, buffalo, gar, bowfin, and freshwater drum). For example, data for Abiaca Creek, which supplies water to Mathews Brake, indicate that the stream has introduced large sediment loads into the refuge, filling in the brake and destroying bottomland hardwood wetland habitats. Silt deposits have also reduced the depth and extent of wetland habitat and altered normal drainage patterns on the refuge. Repeated silt deposits have killed trees and converted forest composition from water tolerant species to less water tolerant species having fewer benefits to fish and wildlife. Open water aquatic habitat has been lost as silt deposits fill up waterbodies and reduce the depth of the water.

Hillside NWR was purchased fee title by the COE for its Hillside floodway "Yazoo Basin Headwater Project." The purpose of the project was to allow silt-laden waters to drop their sediment loads before reaching the Yazoo and Mississippi Rivers, preventing costly dredging projects. The COE project has transformed most of the land into a silt collection sump via a cutoff levee containing the altered channels of Black and Fannegusha Creeks. Although the Hillside floodway project is just beyond half of its estimated 50-year life, the silt collection capacity of the land is nearing the 50-year estimated capacity.

Cultural Resources

With the enactment of the American Antiquities Act of 1906, the U.S. Government recognized the importance of cultural resources to the national identity and sought to protect archaeological sites and historic structures on those lands owned, managed, or controlled by the United States. Historic preservation laws have expanded dramatically since 1906. Several themes recur in the laws and the promulgating regulations, including directives that Federal agencies will:

1. Systematically inventory holdings for "historic properties" and scientifically assess each property's eligibility for the National Register of Historic Places;

2. Consider the impacts to cultural resources during agency management activities and seek to either avoid or mitigate adverse impacts;

3. Protect cultural resources from looting and vandalism by informed management, law enforcement efforts, and public education;

4. Increase consultation with relevant groups (such as Native American tribes and African American communities), to address how a project or management activity may impact specific archaeological sites and landscapes deemed important to those groups; and

5. Identify, research, and protect historic properties, and provide cultural interpretation for the public.

Cultural resource inventories have been completed on about 25,000 acres throughout the Complex. Yazoo, Mathews Brake, and Hillside NWRs have been surveyed prior to and following acquisition. The only refuge in the Complex with significant cultural resources to date is Yazoo NWR, with five properties eligible for listing in the National Register of Historic Places. Yazoo's potential National Register sites include the Swan Lake Indian mounds, Deer Lake Village, Deer Lake Village South, the Steele Bayou site, and the Big Lake site. These sites need to be added to the National Register.

Private Lands and Forest Fragmentation

Panther Swamp NWR contains the largest contiguous block (21,000 acres) of forest in the Complex. Actively managed to improve forest composition for wildlife dependent on interior forest habitats, Panther Swamp NWR's forestlands are rare in the Mississippi Delta region. Although federal- and state-owned lands are managed and protected, habitat losses on private lands continue. Land clearing, one-time "high grade" timber harvests, aquaculture, and urbanization are ongoing threats to the few remaining forests on private lands.

The National Wildlife Refuge System could never acquire enough land to meet the habitat needs of all resident and migratory wildlife. Imperiled wildlife such as neotropical migratory birds, some waterfowl, and threatened and endangered species are dependent on lands in private ownership, as well as government owned lands. While many landowners are actively managing all or portions of their lands for wildlife, many others depend on their lands to produce an income for them and their families.

Technical and financial assistance is available to help private landowners develop and manage habitat. Financial assistance would provide funding for habitat restoration projects that can restore habitat for species at risk, wetland species, forest interior species, and threatened and endangered species. Because government-based financial resources are becoming limited, efforts to restore habitat will be prioritized for areas of greatest need.

GENERAL ADMINISTRATION

Funding and Staffing

Limited staff, facilities, equipment, water management capability, and other factors have prevented refuges in the Complex from accomplishing many defined purposes and management objectives. Staff shortages at Panther Swamp, Hillside, Morgan Brake, and Mathews Brake NWRs (Table 11) have limited management capabilities over the years. The 63,344 acres on these four refuges are currently staffed with only five staff members and three intermittent employees. Panther Swamp NWR has only three approved FTE's, and currently only two positions are filled. Hillside and Mathews Brake NWRs are unstaffed. Staff shortages are compounded by the necessity of sharing limited equipment and facilities with other refuges in the Complex. Further, problems are introduced by the necessity of managing large expanses of refuge lands that are separated by 50 or more miles. The end result is a serious negative impact on biological, maintenance, and visitor services programs, degraded facilities, limited wildlife and habitat projects, and nonexistent visitor services programs.

Table 11. Acres managed by station, approved full-time equivalents (FTEs), and full-time positions funded by other sources.

Refuge Office	Refuge(s) Managed	Acres Managed	Complex/Refuge Staff
Complex Headquarters (located at Yazoo NWR)	Hillside Holt Collier Mathews Brake Morgan Brake Panther Swamp Theodore Roosevelt Yazoo	77,090 acres of refuge lands inside acquisition boundaries. 12,291 acres in (43) Farm Service Agency Fee Title 998 acres in (12) Farm Service Agency easements 80 acres in (1) MDOT Transfer (included in Carter Tract) 80 acres in (1) Fee Title (Theunissen) Darlove Tract Total 90,459 acres	Project Leader (GS-14) Deputy Project Leader (GS-13) Forester (GS-12) Park Ranger (LE) (GS-9) Private Lands Biologist (GS-11) Wildlife Biologist (GS-11) Administrative Officer (GS-9) Tractor Operator (WG-6)* (Shared) Office Clerk (GS-5)**
Yazoo NWR	Yazoo	13,022 acres	Automotive Worker (WG-8) Equipment Operator (WG-9) (Shared)
Morgan Brake NWR	Hillside, Mathews Brake, and Morgan Brake	25,371 acres	Refuge Manager (GS-11) Biological Technician (GS-7) Park Ranger (Interpretive)(GS-7) Equipment Operator (WG-8)++ (Shared)
Panther Swamp NWR	Panther Swamp	38,697 acres	Refuge Manager (GS-11) Park Ranger (Interpretive) (GS-7) Equipment Operator (WG-10)
TOTAL Complex Staff			**16 approved FTE's + 2 positions funded by COE and Hunt Permit Fees**

*Funded by Corps of Engineers funds
**Funded by Hunt Permit Fees
++FTE for a WG-8 Equipment Operator position is currently stationed at Yazoo NWR.

Note: Two FTEs for equipment operators are stationed at Yazoo NWR, but the employees in these positions serve more than half their time at Morgan Brake, Mathews Brake, or Panther Swamp NWRs. Two staff positions (Tractor Operator (WG-6) and Office Automation Clerk (GS-5) are occupied by full-time staff but their positions are not approved FTEs.

Biological and public use review teams and the public identified the need for additional staff, especially at Panther Swamp, Morgan Brake, Mathews Brake, and Hillside NWRs. The table below breaks down the current staff situation by refuge.

Monitoring, Inventory, Research, and Adaptive Management

To date, management decisions have been based on the best available data and best professional judgment. Due to limited personnel and funding, refuge management activities have focused on producing habitats that support priority species, instead of species monitoring and inventory. Therefore, baseline information is absent for:

- Habitats, wildlife, fisheries, and biodiversity.
- Comprehensive, Complex-wide species-based habitats.
- Geographic Information Systems-based data.
- Population inventory and monitoring.
- Current populations, rate of spread, and structured control measures for invasive species.
- Centralized data storage program.

Although this information is vital to adequately support scientifically based management decisions, refuges in the Refuge System are typically not staffed or funded to function as research stations. Therefore the Complex is dependent upon partnerships with other federal agencies, state agencies, non-governmental offices, and universities to conduct research that will guide and support habitat management decisions and habitat restoration projects.

IV. Management Direction

INTRODUCTION

This chapter describes the goals, objectives, and strategies that would be used to implement a science-based stewardship program for fish and wildlife resources on the Complex. Over the next 15 years the management directions outlined in this CCP will guide how the Complex will:

- Meet refuge objectives and support the mission of the Refuge System;
- Manage native wildlife to achieve habitat management objectives for federal trust species, and
- Achieve biological integrity for other native flora and fauna.

While the priority of the Fish and Wildlife Service and the Refuge System is the protection of federal trust species (e.g., migratory birds, threatened and endangered species, anadromous fish and marine mammals), the mission identifies responsibility for all fish, wildlife and plant resources. On national wildlife refuges, wildlife conservation is the first priority in refuge management. Wildlife-dependent recreation (e.g., hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation) will be emphasized. Public uses are allowed if they are compatible and appropriate with wildlife and habitat conservation.

National Wildlife Refuge System Mission:

> *"To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife and plant resources and their habitats within the United States for the benefit of present and future generations of Americans."*

The Service assumes responsibility for managing non-migratory wildlife that are dependent on refuge resources, but never to the detriment of the purpose for which the refuge was established. A variety of LMRAV wildlife species inhabit refuge lands on the Complex, and some of those species are highly visible and valued by the public (e.g., white-tailed deer, wild turkey, and cottontail rabbits) Although these game species are important to the public for their recreational values, non-game species are equally important. To maintain the biological integrity, diversity, and environmental health of the Refuge System, management should include baseline information on all wildlife and their habitats to document their existence, monitor trends, and understand the impacts of refuge programs on biodiversity.

Four alternatives were identified for managing Complex lands:

- A - No Action,
- B - Balanced Habitat and Public Use Emphasis,
- C - Public Use Emphasis, and
- D - Interior Forest Habitat Emphasis.

All of the alternatives are described in the Alternatives section of the Environmental Assessment. However, the Service selected Alternative B - Balanced Habitat and Public Use Emphasis as the proposed alternative, since it was determined to best meet the goals and vision of the Complex and the refuges. Implementing Alternative B would result in a diversity of habitats for a variety of fish and wildlife species, while meeting the Complex's primary purpose of providing habitat for waterfowl. Alternative B would increase waterfowl and songbird use and production, increase protection for forest interior-dependent wildlife on Panther Swamp NWR, enhance resident wildlife populations, restore wetlands and hydrology, and provide greater opportunities for a variety of compatible wildlife-dependent recreation and education activities.

VISION

The vision for the Theodore Roosevelt National Wildlife Refuge Complex is:

> *Based on sound science, the Theodore Roosevelt National Wildlife Refuge Complex will protect, manage, and, where appropriate, restore a system of lands and waters to provide for wildlife, fisheries, and plants and their habitats within the Mississippi River's Yazoo Backwater Area for the benefit of present and future generations of Americans.*
>
> *The Complex will expand its role in land protection efforts by acquiring (from willing sellers) additional habitats for migratory birds and other federal trust species while working with all interested parties to promote conservation efforts on non-refuge lands. The Complex will play a critical role in reducing forest fragmentation and lead in reforestation and restoration of bottomland hardwoods and other wetlands. The Complex will provide and promote research opportunities that lead to an understanding of the resource management needs of the Lower Mississippi River Ecosystem.*
>
> *The Complex will build partnerships to protect and promote the ecological viability of the landscape, wildlife-dependent recreation, and the historical and cultural resources of the region. When compatible, wildlife-dependent recreational opportunities for hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation will be provided while promoting the public's understanding of the purposes of the Complex and the mission of the National Wildlife Refuge System.*

GOALS, OBJECTIVES, AND STRATEGIES

Seven goals have been identified to meet the issues, concerns, and needs expressed by the planning team, the refuge staff, the governmental partners, and the public.

The defined objectives and strategies for each goal reflect the Service's commitment to the National Wildlife Refuge System Improvement Act of 1997, the mission of the National Wildlife Refuge System, the North American Waterfowl Management Plan, the Partners-in-Flight Plan, and the purposes of and vision for the Complex. Goal accomplishment is dependent upon the availability of adequate funds and staff over the next 15 years. Maps for proposed habitat management and visitor services can be found at the end of this chapter.

GOAL 1. HABITAT AND SPECIES MANAGEMENT – Maintain habitat and species representative of the lower mississippi river valley, with special emphasis on waterfowl, other migratory birds, and threatened and endangered species.

Discussion: The Complex provides a diversity of habitats for resident and migratory species. Although four of the refuges in the Complex were established to provide for the habitat needs of migratory birds with an emphasis on waterfowl, refuges in the Refuge System are responsible for all native species occurring on refuge lands. Therefore, habitat for fish and other wildlife is managed to suit the needs of the largest variety of species.

All five refuges in the Complex have been designated by the Audubon Society as "Important Bird Areas." Complex lands provide forest habitat, grasslands, and scrub/shrub habitat for neotropical migratory birds, such as prothonotary warblers, bobolinks, dickcissels, painted buntings, and white-eyed vireos. A diversity of habitats, including sanctuary areas for waterfowl, provide feeding, resting, and loafing habitat for tens of thousands of wintering ducks and geese, and nesting habitat for wood ducks and hooded mergansers. Moist-soil management areas provide foraging habitat for non-game waterbird groups, including shorebirds, marsh birds, and colonial waterbirds/wading birds.

Breeding colonial wading birds use nesting habitat in brakes, swamps, and a few wooded impoundments throughout the Complex. Yazoo NWR's Deer Lake provides extensive beds of giant cutgrass for nesting habitat for marsh species, such as grebes, moorhens, gallinules, rails, and bitterns.

Panther Swamp NWR contains one of the few remaining large interior forests in Mississippi, similar to the forests that historically supported millions of songbirds in the LMRAV. Its proximity to larger blocks (>10,000 acres) of similar forested habitat, such as Delta National Forest, provides an opportunity to link management efforts with partnering Federal and State agencies to manage habitat for priority interior forest-dependent birds.

Concern over waterfowl population declines in the 1980s resulted in the establishment of the North American Waterfowl Management Plan, which focused the attention of federal, state, and private conservation groups on critical wintering and breeding areas. The LMVJV was selected as one of the wintering focus areas. In setting habitat objectives for the LMVJV, the consensus was that foraging habitat is the limiting factor. The objectives are based on food production goals by habitat types including harvested and unharvested cropland, moist-soil areas, and bottomland hardwood wetlands.

Each of these habitat types is required to provide the variety of food resources (i.e., native plant seeds, small grains, and invertebrates) required by waterfowl wintering in the Lower Mississippi River Valley. Step-down objectives were established in Mississippi for public and private lands.

Guidelines for minimum duck-use day objectives were determined by using a series of step-down plans starting with the North American Waterfowl Management Plan (NAWMP) population objectives. These objectives were further stepped down to the LMVJV, which were then allocated to each state. Coordination meetings were held in each state to determine who could provide the habitat requirements and where the habitat would be located (public or private lands). Taking into account sanctuary requirements (in addition to foraging requirements), public land managers determined the potential for meeting state objectives. Each of the refuges within the Complex was then allocated a minimum number of duck-use days (Table 12) based on past wintering waterfowl surveys and available habitat types. These population objectives were translated into minimum habitat objectives for bottomland hardwoods, moist soil, and unharvested crops.

Table 12. Lower Mississippi Joint Venture step-down objectives (2003) for dabbling ducks for the Theodore Roosevelt National Wildlife Refuge Complex

Refuge/ Unit	DUD Objective	Greentree Reservoir (Objective)	Greentree Reservoir (Current)	Moist Soil (Objective)	Moist Soil (Current)	Unharvested Crops (Objective)	*Unharvested Crops (Current)
Yazoo	6,521,991	275	1,350	559	650	350	788
Panther Swamp	8,172,000	0	0	1,235	400	300	470
Carter Tract	2,155,700	0	0	600	600	100	200
Hillside	2,529,533	1,200	200	236	200	50	290
Morgan Brake	5,951,004	0	0	1,175	589	222	172
Mathews Brake	975,350	50	50	700	0	0	0
TOTALS	26,305,578	1,525	1,600	4,505	2,439	1,022	1,920

*25 percent share of cooperatively farmed crops

Currently 9,600 acres of small grain crops are planted on refuge lands (excluding Mathews Brake NWR). Assuming a 25 percent refuge share, 2,400 acres would be available to provide small grain crops for waterfowl. This exceeds the NAWMP's 1,022-acre goal for ducks; however, the Waterfowl Focus Group identified an additional objective of 1,200 acres of unharvested grain crops for geese, bringing the total unharvested grain crop minimum objective to 2,222 acres (1,022-acre NAWMP objective for ducks, and 1,200-acre Waterfowl Focus Group objective for geese). Complex agricultural acres have already been reduced by approximately 20,840 acres since 1980 and will continue to be reduced to a level commensurate with identified waterfowl objectives.

The initial duck-use days and habitat objectives are currently being reevaluated by the LMVJV. Foods (including waste grain), suitable habitat available on private lands, and the evaluation of wintering waterfowl population surveys on the Complex may produce changes in the objectives in the near future. New information preliminarily demonstrates that earlier harvests and more efficient harvest techniques have resulted in less available waste grain for wintering waterfowl on private lands. When crops are harvested earlier in the year, waste grain sprouts and grows, eliminating its use for waterfowl during the wintering season.

As the studies are concluded, the objectives will be re-evaluated. For this reason, most agricultural lands targeted for removal from the cooperative farming program will be converted to scrub/shrub, grasslands, and moist-soil habitat. This will provide habitat for a variety of wildlife, and would allow the conversion back to crop lands should the objectives for unharvested crops be increased. In the future, if the need for additional crop lands is determined unnecessary, a portion of the lands converted to scrub/shrub, grasslands, and moist-soil habitat could be restored to bottomland hardwoods.

Sub-Goal 1A. Waterfowl sanctuary – Provide effective waterfowl sanctuaries on all refuges within the Complex.

Discussion: Sanctuaries are necessary to reserve the habitat elements essential for waterfowl survival and to serve as reservoirs from which populations can be replenished. Sanctuaries also protect waterfowl from over-harvest (Munro 1964). Sanctuaries have long been considered an important part of waterfowl management (Bellrose 1954), although research on their role in maintaining populations has received limited attention. However, individual studies have illustrated some of the biological values of sanctuaries. Banding on and off refuges has shown that sanctuaries reduce the effects of hunting mortality on mallards (Blohm et al., 1987). Excessive disturbance by hunters has been shown to reduce the fat storage and feeding success of greater snow geese (Feret et al., 2003) and increase energy expenditure by several species of migrating and wintering waterfowl (Havera et al., 1992, Kahl 1991). Also, mallards and other species preferentially use undisturbed forested wetlands for pairing and other social activities in the Lower Mississippi Valley during winter (Fredrickson and Heitmeyer 1988). Sanctuaries provide wintering waterfowl with food, cover, and water, and provide areas for pair bonding. Waterfowls in sanctuary areas can maintain vital fat reserves that they will need for long distance migration. Ducks lacking sanctuary use more energy, reducing their fat reserves.

Objective 1A. Maintain a minimum of 18,300 acres for waterfowl sanctuary Complex-wide, where few to no disturbance factors are allowed during the critical winter period (January 1 through March 15.)

Discussion: The establishing legislation for four of the refuges (excluding Hillside NWR) is "for use as an inviolate sanctuary for migratory birds."

Strategy*:*

- Designate the listed minimum acres of sanctuary by posting signs, closing gates, and providing information in brochures and other public information.

Yazoo NWR	1,981 acres
Panther Swamp NWR	9,255 acres
Hillside NWR	2,029 acres
Morgan Brake NWR	4,190 acres
Mathews Brake NWR	833 acres

Sub-goal 1B. Moist-soil/shallow-water impoundments – Provide moist-soil/shallow-water impoundments for a variety of species.

Discussion: "The principle of increasing the seed production of annual plants with seasonal drawdowns of moist-soil sites was recognized in the 1940s but not applied as a management strategy until the 1970s. Moist-soil habitats are natural or managed, seasonally flooded wetlands dominated by grasses, sedges, or other herbaceous plants. The availability of plant seeds attracts and concentrates waterfowl and other wetland wildlife species. Decomposing vegetative parts of moist-soil plants also provide substrata for invertebrates, which are vital foods for many wetland wildlife and fish. Moist-soil impoundments generally produce more food and are more consistently productive than bottomland forests." (Reinecke et al., 1989).

Because moist-soil management requires personnel, equipment (wells, pumps, tractors, disks, mowers), chemicals, and energy resources (gasoline, diesel, electricity), costs can be substantial compared to cooperative farming. However, natural wetland losses in areas surrounding refuge lands in the Complex have created the need for managed wetlands on protected areas, to ensure essential habitat and food resources for wetland-dependent wildlife species' health and survival. A variety of waterfowl species use moist soil and shallow water impoundments. Table 13 depicts current water management capability on the Complex.

Table 13. Water control structures and wells*

Refuge	Existing WCS	Existing Wells
Yazoo	92	18
Panther Swamp	36	5
Carter Tract	22	9
Hillside	12	3
Morgan Brake	30	14
TOTALS	192	49

*Needs for water control structures and wells are addressed in Maintenance Management System (MMS) and Refuge Operating Needs System (RONS) documents

Objective 1B.1. Waterfowl: Annually, provide a minimum of 4,500 acres of moist-soil/shallow-water habitats for waterfowl to support national and regional plans.

As discussed in "Habitat Management for Migrating and Wintering Waterfowl in North America" (Reinecke et al., 1989), "the objectives of many waterfowl management areas in the Mississippi Alluvial Valley (MAV) are to provide habitat for migrating and wintering waterfowl and maintain a diversity of wildlife species." Habitat complexes can satisfy these objectives more effectively than individual habitats because the strengths of one management method compensate for the

weaknesses of another. Forested wetlands provide excellent wildlife habitat with low management costs, but food production for waterfowl is limited. Moist-soil impoundments are intermediate in management costs and food production, and provide habitat for a diversity of wetland and upland wildlife species. Crop production provides the greatest yield of waterfowl food per unit area, but management costs are high and benefits to other wildlife generally are low. Habitat complexes are also complementary regarding quality of waterfowl foods produced. Croplands primarily provide energy, whereas natural foods contribute energy, protein, and other nutrients.

Although the advantages of habitat complexes are clear, the best ratio of habitat types is less obvious. Farming probably should be limited to the minimum area necessary to satisfy food production objectives that are not attainable with moist-soil impoundments and forested wetlands. Moist-soil impoundments generally produce more food and are more consistently productive than bottomland hardwood forests. Forested wetlands should remain an important habitat on refuges in the MAV because of their low management costs and general wildlife habitat values."

In order to meet the 19.1 million duck-use-day minimum objective in national and regional plans, including the North American Waterfowl Management Plan, appropriate Complex lands will be managed to provide habitat, food resources, and sanctuary for ducks.

The Complex will manage a minimum of 4,505 acres of moist soil habitat within current acquisition boundaries to encourage the growth of moist-soil plants for seed production, and to encourage invertebrates that will provide a food resource for a variety of wetland-dependent migratory birds.

Strategies:

- Install water level gauges on all managed impoundments with infrastructure in place for complete water control.
- Maintain early successional moist-soil plant communities and control undesirable plants by such means as mechanical disking, herbicides, periodically rotating agricultural crops, and water level management.
- Implement a system to record water levels, habitat manipulations, plant coverage, and migratory bird response in all appropriate impoundments, and use adaptive management procedures to improve results.
- Continue to use the rotational management scheme at the Cox Ponds (Yazoo NWR) to develop a cycle of early successional development and renewal that will supply optimum forage and habitat conditions for target species. Apply successful techniques from the Cox Ponds to other moist-soil impoundments throughout the Complex.
- Develop infrastructure to provide the capability for complete water control on all appropriate impoundments.
- Develop a protocol for managing moist-soil areas with only partial water control, using 400 pounds-per-acre as a minimum production rate. If the minimum cannot be achieved, consider planting millet or converting to row crops.
- Develop a GIS database of all water management units that includes floodable acreage, water control structures, soil types, vegetation transects, flood chronologies, and manipulations.
- Conduct and keep records of in-depth plant surveys at least twice annually in all moist-soil management units.
- Replace water control structures and wells (as needed) on the Complex and install new wells and water control structures to provide maximum water control.

Objective 1B.2. Long-legged Waders: Provide a minimum of 700 acres of shallow-water habitat during the nesting and post-nesting periods for long-legged waders.

Discussion: On selected impoundments, moist-soil and shallow-water management strategies can be structured to provide foraging habitat for long-legged waders. This is especially important during brood-rearing and post-nesting periods.

Strategies:

- Draw down selected deep-water/moist-soil impoundments at Yazoo and Morgan Brake NWRs and the Carter Tract to a depth of 12" on April 1, prior to the shorebird drawdown in July, to provide foraging habitat for wading birds during the nesting and post nesting periods.
- Draw down deep-water/moist-soil impoundments slowly over the season to allow crawfish to burrow-in for reproduction.
- Incorporate red swamp crayfish (Procambarus clarki) production scheme into moist-soil and rice-management programs to enhance aquatic resources for wildlife and enrich wildlife observation opportunities.
- Provide shallow-water areas in late spring and early summer to concentrate prey for long-legged waders, such as the state-listed wood storks, little blue herons, and the declining white ibis.

Objective 1B.3. Marsh birds: Annually, provide a minimum of 60 acres of marsh bird habitat for nesting and migration in three 20-acre ponds: one at Morgan Brake and two at the Carter Tract.

Discussion: Management strategies to benefit marshbirds will be developed with special emphasis on habitat for black rails, yellow rails, and least bitterns.

Strategies:

- Manage one 20-acre pond at Morgan Brake NWR and two 20-acre ponds at the Carter Tract for marsh habitat.
- Maintain marshbird habitat at Deer Lake, with a mix of perennial marsh species such as giant cutgrass, sedges, rushes, and cattail.

Objective 1B.4. Shorebirds: Provide a minimum of 435 acres of shallow-water habitat for fall shorebird migration.

Discussion: Shorebirds forage in mud flats and other moist soil areas. Peak northbound migration occurs from March to mid-May. Existing habitat for northbound migration is considered adequate in the LMRAV. Southbound migration starts in early July, peaks August through September, and tapers off toward winter, usually lasting until at least the end of October. Severe shorebird habitat shortages occur when shallow-flooded or mudflat habitats are unavailable in late summer/fall.

For Mississippi, a 1,500-acre habitat target that would support a tentative 500,000 LMRAV population objective has been established for southbound migration. This objective is based on conservative assumptions, and experts believe that the figure may be as much as twice that estimated. Because shorebird habitat is one of the highest non-game bird priorities for the Complex, existing shorebird management practices will be continued and opportunities for improvement will be implemented.

Strategies:

- Based on current management capability, manage 240 acres at Yazoo NWR's Cox Ponds and 300 acres at Morgan Brake NWR's moist-soil ponds on a 4-year rotation; 600 acres at the Carter Tract and 300 acres at Morgan Brake NWR on a 3-year rotation, resulting in 60, 75, 200, and 100 acres in each area, respectively, (total 435 acres) for fall shorebird habitat each year.

- Manage shallow-water habitat on at least 435 acres, Complex-wide, to provide shorebirds with adequate protection from disturbance and to provide optimal feeding conditions for southbound shorebirds. Habitat should consist of a combination of mudflats and shallow water (0 - 4") with a dense invertebrate population, and be available July 15–October 31.

- Begin final draw-down of water levels in mid-summer to expose mud flats for southbound shorebirds. Draw-downs among moist-soil units should be staggered and overlapped to continue to provide mud-flat habitat throughout the entire mid-July to November migration period.

- Develop a moist-soil/shallow-water habitat rotation scheme to provide fall shorebird habitat on at least 25 percent of the acreage being rotated.

- Install tilt pipes for precise water control in all shorebird management impoundments.

Sub-goal 1C. Enhance Wetlands and Aquatic Sites on the Complex

Discussion:

Yazoo NWR: The largest body of water on Yazoo NWR is Swan Lake, which is divided into four management compartments, and is bounded on the east side by Steele Bayou. The majority of Swan Lake contains water-adapted trees (bald cypress, willow, water elm, ash, swamp privet) and shrubs (buttonbush) interspersed with open water. The largest and deepest compartment (#4) is maintained as a permanent swamp and contains a large colonial waterbird rookery. The adjacent compartments (#2 and #3) are flooded by rainfall and runoff in the fall and winter and are drained in the spring to allow moist-soil plant growth and to protect important mast trees (such as Nuttall oak) around the edge that are less adapted to flooded conditions.

Pipe-arch structures allow water to inflow from Silver Lake Bayou to fill Compartments #3 and #4 in the fall. This is an option that can be used when silt loads are low in the bayou. Compartments #2 and #3 are drained in the spring and water levels in Compartment #4 are lowered. Much of Compartment #1 is managed as a GTR. It is separated hydrologically from Compartments #2, #3, and #4 and contains relatively higher ground, but is flooded on the same schedule.

The portion of Steele Bayou that lies within the refuge boundary is controlled by a COE weir downstream from the refuge. Weir E, located at the mouth of Silver Lake Bayou on the north end of the refuge, controls water levels in Silver Lake Bayou. Weir E is manipulated by refuge personnel for habitat management and to reduce flooding impacts to private lands upstream. A controversy (from private landowners) over the elevation of the weir shortly after construction resulted in the removal of one foot of concrete from the weir. As a result, water levels upstream of the weir do not provide adequate flow into Swan Lake for habitat management purposes.

The COE proposes to relocate a portion of Steele Bayou on the north end of the refuge, to resolve issues associated with unstable soils. When the COE purchases additional land to relocate the channel, there is a potential that this land could be donated to the refuge, altering the refuge boundary on the north side.

Deer Lake is a permanent water area with marsh habitat containing giant cutgrass in shallower areas. Several species of marsh birds use it for nesting and brood-rearing. Deer Lake is relatively shallow (<6 feet) and subject to lotus overgrowth. Refuge staff treat the lake with glyphosate periodically to reduce the American lotus. Deer Lake historically has produced the greatest numbers of wood ducks compared to other habitats on the refuge, possibly due to the greater number of wood duck nest boxes in the lake, and the habitat Deer Lake provides.

Alligator Pond, also a productive wood duck nesting site, is subject to overgrowth of American lotus, and glyphosate is applied periodically. Water levels are raised in winter to flood the surrounding hardwoods (as in a GTR). The majority of remaining permanent-water impoundments such as Beargarden Lake, Lizard Lake, and Big Lake incorporate a GTR management component in the surrounding backwater areas.

Panther Swamp NWR: A water control structure in Deep Bayou controls a major portion of the east side drainage on this refuge. During the winter, water levels are raised to flood brakes and forested areas. In the spring, water is released to protect bottomland hardwoods. A rapid release of water is desirable to discourage beaver activity and to prevent silt buildup. A deterrent to the rapid release of water is the fixed-level COE weir that is located downstream in the Landside Ditch. The purpose of the weir is to hold water, which controls vegetation in the Landside Ditch. The Landside Ditch drains the entire east side of the refuge. The Landside Ditch weir slows water flows, which allows silt build-up in refuge drainage/waterways. The silt build-up makes it easier for beavers to build dams, causing increased expenditures of time and effort for dam removal, resulting in the loss of mature bottomland hardwoods.

Mathews Brake NWR: Mathews Brake NWR includes a 1,810-acre oxbow lake with ridge-and-swale topography. Deeper water areas contain baldcypress and water tupelo, and higher elevations contain bottomland hardwoods. Portions of the lake are in private ownership. Historically, water flowed into the southeast corner of Mathews Brake via a tributary of Abiaca Creek. During periods of normal water levels in the Abiaca tributary, water was allowed to pass through a 40-inch pipe under a woods road. To prevent the brake from completely drying up during the hot summer months, refuge staff diverted water into the brake through the 40-inch pipe starting in June. By the beginning of duck season, rains and water diversions had filled the brake to the desired level. After heavy rains, when the stream carried a substantial silt burden, the pipe was closed.

A flood event in February 2004 washed out the pipe, silted in the channel, and effectively cut off Mathews Brake's water supply. A new channel was proposed to provide water to the brake via a tributary of Abiaca Creek. Because the channel construction project would result in the deposition of fill material in wetlands, the COE was contacted in March 2004. Refuge staff met with COE personnel on-site, and discussed permit requirements. Subsequently, a COE Section 404 nationwide permit was verified to authorize the work, and the new channel was constructed in late 2004. Water levels in the brake are now controlled by two water control structures at the head of the new channel.

Objective 1C.1. Improve water management capabilities on Yazoo, Mathews Brake, Panther Swamp, Hillside, and Morgan Brake NWRs to address habitat management issues.

Strategies:

- On Yazoo NWR, work with the COE to raise the elevation of Weir E by one foot to ensure gravity flow of water into Swan Lake.
- On Yazoo NWR, work with the COE to minimize habitat impacts during the COE's completion of the Swan Lake project.
- Establish and cultivate partnerships with the COE to develop plans for lowering the weir at Landside Ditch above Cotton's bridge to increase water velocity and reduce siltation in sloughs on the east side of Panther Swamp NWR.
- On Hillside NWR, work with the COE to minimize siltation from upland sources.
- On Morgan Brake NWR, divert the road 200 feet away from the spring adjacent to North Hill Ponds, and revegetate the area surrounding the spring with native shrubs.

Objective 1C.2. Within 1 year of CCP approval, control beaver populations to ensure that no more than 5 percent of bottomland hardwood wetlands are converted to aquatic sites.

Discussion: Refuge lands in the Complex contain extensive expanses of wetlands with varying sources and extent of hydrology, from deepwater swamps to bottomland hardwood wetlands. Panther Swamp NWR has the largest contiguous block (20,000 acres) of bottomland hardwood wetlands in the Complex. Although beaver ponds do provide limited habitat for some waterfowl and aquatic species (wading birds, reptiles, amphibians), forest losses are substantial.

Strategies:

- Aerial plant rice or Japanese millet for waterfowl on 10 percent of areas with beaver-killed trees as they are drained.
- Allow areas to undergo natural succession as beaver-killed areas are drained.
- Employ a full-time GS-7 biological technician to implement a beaver and nutria control program (including shooting and trapping and removing dams) and to monitor and record tree damage.

Objective 1C.3. Provide and protect habitat for threatened and endangered species on Complex lands.

Discussion - Interior Least Tern: Interior least terns have historically bred and nested from late April to August on barren and sparsely vegetated sandbars, as well as sand and gravel pits along the Mississippi, Missouri, Ohio, Red, and Rio Grande Rivers. They feed in shallow waters on fish, insects, crustaceans, mollusks, and annelids (Whitman 1988). However, river channel alterations for navigation, hydropower, irrigation, and flood control have destroyed their nesting and breeding habitat. Many remaining sandbars are unsuitable for nesting due to vegetation encroachment or frequent flooding. As a result, the number and distribution of interior least terns have declined. In 1985, interior least terns were placed on the Endangered Species List in many states, including Mississippi, and the recovery plan was developed by the Fish and Wildlife Service in 1990.

Small numbers of interior least terns forage in Swan Lake on Yazoo NWR in the summer. Since the refuge lies only 4 miles from the Mississippi River, an opportunity exists to provide summer foraging habitat at the Cox Ponds moist-soil areas, if a suitable forage species can be provided in the management scheme. They have been known to breed along the Mississippi River in Washington County in the vicinity of Yazoo NWR, and have been observed foraging at Yazoo and Morgan Brake NWRs by refuge staff.

Strategies:

- Provide foraging habitat for interior least terns.
- Stock open-water areas on selected deep-water impoundments with forage fish (e.g., shad and other suitable fish).

Discussion - Pallid Sturgeon: Pallid sturgeon (*Scaphirhynchus al*bus) are bottom-feeding fish that prefer large, muddy rivers with rocky or sandy bottoms. They can be found in backwaters, side channels, sloughs, and in the main channels. Historically found throughout the Missouri River from Montana to the Mississippi River and then south to Louisiana, virtually all of the pallid sturgeon's habitat has been altered by dams, reservoirs, and channelization projects. Pallid sturgeon are known to occur in the Yazoo River, adjacent to Panther Swamp NWR.

Strategy:

- Protect pallid sturgeon and their habitat and minimize threats from existing and proposed activities on refuge lands by ensuring that loggers implement appropriate Best Management Practices (BMP's) during forest harvest operations on refuge lands adjacent to the Yazoo River.

Discussion - Pondberry: Pondberry (*Lindera melissifolia*) is a deciduous shrub that grows to about 2 meters in height. Yellow flowers in early spring yield a fleshy bright red drupe in fall. This endangered shrub grows in bottomland forests, poorly drained depressions, and in limestone sinks. Habitat loss is the primary threat to the continued existence of this species. Pondberry has been introduced in experimental populations on Yazoo, Morgan Brake, and Hillside NWRs.

Strategies:

- Work with Jackson, Mississippi, Ecological Services Field Office to identify pondberry populations on Complex lands.
- Provide suitable habitat for additional pondberry introductions.

Objective 1C.4. Wood ducks: Provide brood habitat and nest sites to support a target of 3,000 hatchling wood ducks each year on Complex lands.

Discussion: Overharvest of mature hardwood trees in the early 1900's nearly extirpated wood duck populations. Studies demonstrate a scarcity of suitable nesting cavities in existing bottomland hardwoods. In addition, competition (e.g., from raccoons, squirrels, and owls) for suitable cavities further limits nesting habitat. However, today, wood ducks are common LMRAV residents, largely due to the introduction of wood duck nest boxes in preferred habitats. Wood ducks are not territorial, and often more than one hen will lay eggs in the same nest. The hen will typically lay 12-14 eggs. Dump nests containing 25 or more eggs are common, and often produce successful broods. Although wood ducks may seek cavities in trees within a mile of water, brood survival is higher where

nests are closer to water. Preferred habitats include forested wetlands, wooded and shrub swamps, tree-lined rivers, streams, sloughs, and beaver ponds. Wood ducks seek acorns, other soft and hard mast, weed seeds, and invertebrates in shallow flooded timber, shrub swamps, and along stream banks. They loaf and roost in more secluded areas and in dense shrub swamps.

Wood duck nest boxes should be maintained and checked at appropriate intervals throughout the breeding season. Box cleaning after the initial nesting peak (about mid-April) will help improve annual production. Wood duck nest boxes must be fitted with functional predator guards, and maintained, or they become traps for the hen and her clutch.

Waterfowl biologists have long known that nest success is of primary importance for wood duck populations. However, hatched ducklings comprise only one component of the equation. Another critical component is duckling survival after nest exit. Historically, natural nest cavities may have been more widely dispersed throughout bottomland hardwoods, with more extensive scrub/shrub habitats than today. Hens and their broods were better able to disperse and avoid detection by predators in these natural settings. Studies on duckling mortalities associated with wood duck boxes on Yazoo NWR by Mississippi State University revealed that overall duckling survival was only 20 percent, with predators accounting for 69 percent of loss. When ducklings traveled to scrub/shrub and bottomland forest habitats with no wood duck nest boxes, duckling survival was 60 percent (Kaminski, et al., 2003). Possibly, predators have learned to target areas with a high density of wood duck nest boxes, which may result in an “ecological trap” for ducklings. Because fall is normally the driest time in the LMRAV, wood ducks are often forced to seek food and cover in wetland areas of limited size. Management strategies that ensure adequate wetland habitat during dry times should be developed.

Yazoo NWR has actively managed wood duck nest boxes for nearly three decades. Today, more than 250 nest boxes are maintained and checked annually. Many studies have been conducted over the years on the Yazoo NWR wood duck nest box program. During most years, the wood duck nest box program has been successful, with some boxes used 3 and 4 times during the nesting season.

Strategies:

- Provide year-round habitat and maintain a minimum of 300 nest boxes throughout the Complex to enhance wood duck populations.

- As existing wood duck nest boxes deteriorate, replace and relocate boxes to meet guidelines.
- Place boxes in areas that are readily accessible for inspections.
- Maintain predator guards on all box structures.
- Place boxes in water and close to scrub/shrub habitat when possible.
- Maintain all cull trees that have, or may develop natural nesting cavities and are located within 1 mile of suitable aquatic habitat. This will also benefit many other cavity-nesting species (e.g., woodpeckers, mergansers, and squirrels).
- If possible, place boxes above the 10-year high water mark to prevent them from being flooded and to facilitate access for box maintenance and checks. This is particularly critical on Hillside and Panther Swamp NWRs, two refuges that are flooded on a regular basis.
- Maintain sufficient water levels for brood rearing from February through September.

Objective 1C.5. Colonial Waterbirds: Within 5 years of CCP approval, provide habitat to support a minimum of five colonial bird rookeries on Complex lands.

Discussion: Deep-water wetland habitats on refuge lands in the Complex have supported several colonial waterbird rookeries for many years. On Yazoo NWR, a large, very diverse rookery exists in Swan Lake, with breeding anhinga, great blue heron, great egret, snowy egret, little blue heron, cattle egret, green heron, tri-colored heron, double-crested cormorant, and black-crowned night heron. Several smaller rookeries in other refuge areas have been used intermittently over the years. Hillside NWR supports a large great blue heron/great egret/anhinga/black-crowned night heron rookery, and Morgan Brake NWR has, at various times, supported rookeries containing mostly little blue herons, cattle egrets, and white ibis. Panther Swamp NWR presently has no known rookery. However, a large rookery is located adjacent to the Panther Swamp NWR (White's Lane) that is of some importance for its size and species makeup. This rookery is the largest, and may be the only breeding site in the area for the white ibis, a high priority species that nests here by the thousands. Roseate spoonbills were documented as nesting in the White's Lane rookery in 2004. All other species found in the Swan Lake rookery are also found at the White's Lane rookery.

Foraging habitat for wading birds is present in wetlands throughout the Complex, but particularly in intensively managed moist-soil areas on Yazoo and Morgan Brake NWRs. Hundreds of wading birds gather to feed in the spring and summer, especially during drawdown phases. Much foraging activity is also done off-refuge, particularly at aquaculture facilities throughout the area, where they are subject to anti-depredation loss. The wood stork, a state-listed species, occurs in fair numbers every summer at Panther Swamp NWR, as well as at other stations. Roseate spoonbills have been documented using wetland impoundments at Yazoo and Morgan Brake NWRs.

Priority Species:

- High – Least tern, American white pelican, tri-colored heron, black-crowned night heron
- Local or Regional Interest – Wood stork, roseate spoonbill, glossy ibis, white ibis, anhinga, great blue heron, great egret, snowy egret, little blue heron, cattle egret, green heron, yellow-crowned night heron.

Strategies:

- Protect colonial waterbird rookeries or roosts.
- Provide foraging habitat to support colonial waterbirds.
- Secure protection for the White's Lane rookery adjacent to Panther Swamp NWR through acquisition (from willing sellers) or easement.

Objective 1C.6. Reptiles: Maintain a population of at least 700 alligators, and protect habitats for reptiles, turtles, snakes, lizards, and crocodilians on Complex lands.

Discussion: The American alligator (*Alligator mississippiensis*) was previously listed on the Endangered Species List due to over-harvest and habitat loss. Populations increased with legislated protection, and the alligator was removed from the list in 1987. These large reptiles are a major draw for visitors seeking wildlife observation opportunities. However, nesting alligators are sometimes harassed by the visiting public and can be injured when individuals throw food, debris, or rocks at the alligators to encourage them to move. Since the alligator can be considered a keystone species, the protection of habitat for alligators would also ensure habitat for turtles, snakes, and lizards.

Strategies:

- Map alligator nesting sites using GIS technology.
- Place signs in appropriate locations prohibiting alligator feeding or harassment.
- Protect alligator nesting sites from human disturbance.
- Manage water levels sufficient to support 700 alligators on Complex lands.
- Ensure sufficient bottomland hardwood habitat adjacent to wetlands to provide cover, foraging, and nesting habitat for turtles, snakes, and lizards.

Objective 1C.7. Amphibians: Maintain existing habitat and breeding sites to support resident amphibians on Complex lands.

Discussion: Identifying and conserving breeding sites for amphibians, especially salamander species, are vital for reproductive success. Preferred habitat type is variable according to species. Ephemeral pools (depressions that hold water for less than a year) are especially important for salamanders, and can be found in almost any area, but additional factors such as vegetation characteristics, water quality, and historic use also determine whether a given species would use them for breeding sites. Amphibians are usually philopatric, returning as adults to the site where they hatched and developed, for their breeding activity. If breeding sites are active, this is an indication that suitable habitat exists or has recently existed nearby to support adult populations.

Because salamanders are less mobile than frogs, toads, and reptiles, they are more likely to be impacted by losses in their breeding sites. To maintain and improve reptile and amphibian diversity, and to ensure that habitat is managed for all native species, breeding sites should be identified and conserved, especially for salamander species that are in decline. The following strategies have been identified to conserve reptile and amphibian fauna in support of Partners in Amphibian and Reptile Conservation.

Strategies:

- Using GIS equipment, identify and map breeding sites for amphibian species.
- Conserve breeding sites by maintaining or improving the current vegetation component and water regime.
- Establish buffer zones around breeding sites, if necessary, to protect habitat from pesticide or silt contamination.

Objective 1C.8. Fish: Maintain and/or enhance a minimum of 2,000 acres of deepwater aquatic habitat for a viable fishery.

Discussion: Fish are an important component of the Lower Mississippi River Ecosystem. Historically, the ecosystem supported a great variety of fish adapted to the seasonal flooding of a large river. The inherent productivity of the fishery has changed due to hydrological alterations that have isolated habitats outside the main river levees. The resultant habitat favors species of fish that are less adapted to riverine habitats with dynamic seasonal flooding regimes. Except during extreme flood events, most lands in the Complex are separated from the influence of the Mississippi and Yazoo Rivers. Because it is not possible to reestablish or mimic the river's influence on the majority of the Complex's aquatic habitats, existing deepwater areas will be managed to provide a viable fishery. Public fishing will be encouraged wherever appropriate and compatible.

The listed strategies have been identified to protect and promote self-sustaining fish populations.

Strategies:

- Develop and implement fisheries management (e.g., stocking, ratio adjustment, and habitat improvements) in deepwater aquatic habitats with an emphasis on increasing and maintaining a balanced and healthy sport fish population.
- Develop vegetation buffers of site-appropriate, native vegetation around perimeters of deepwater aquatic sites to cool and shade the water during the summer, and provide roots below the water's surface for fish habitat.
- Place stumps, large woody debris, or other native structure in deepwater aquatic sites to mimic naturally occurring cover.
- Improve water quality by reducing siltation and contaminant loads and turbidity in refuge waters by working with Service contaminants specialist, Mississippi Department of Environmental Quality, and surrounding landowners.

Sub-goal 1D. Agricultural land – Provide grain crops for waterfowl and geese.

Discussion: The Mississippi Alluvial Valley (MAV) is one of two major wintering areas in the lower Mississippi River Gulf Coast region. For many years, the availability of waterfowl migration and wintering habitat was thought to have little effect on waterfowl populations. However, the loss of wintering habitat, coupled with studies showing the interdependence of waterfowl requirements throughout the annual cycle, has led to a clearer understanding of breeding, migration, and wintering habitats requirements. Scientists now believe that a complex of habitats is required to meet waterfowl needs (Reinecke et al., 1989).
"Farming has been an important management practice in the MAV since the first waterfowl refuges were established during the 1930s. Crop production provides the greatest yield of waterfowl food per unit area" (Reinecke et al., 1989). Cooperative farming, an arrangement where refuge land is provided to a farmer in exchange for a portion of the crop, has long been the most economical method for meeting refuge crop objectives. Management, operation, and maintenance costs would be higher if force account farming were conducted by refuge staff using refuge equipment. A few other species like deer, turkey, woodcock, and raccoon benefit from the crops and agricultural land. Crops like corn, milo, and rice primarily provide energy, whereas natural foods contribute energy, protein, and other nutrients. Farming should be limited to the area necessary to satisfy food production objectives.

The North American Waterfowl Management Plan (NAWMP) proposes to provide migration and wintering habitat for mallards (*Anas platyrhynchos*) and northern pintails (*A. acuta*) in the lower Mississippi River and Gulf Coast. To support the North American Waterfowl Management Plan, the minimum habitat objective for unharvested small grain crops is approximately 1,100 acres for the entire Complex. To meet this objective, refuge lands must produce the maximum amount of desirable grain without compromising the cooperative farmer's ability to meet his/her economic burden of crop production. Because corn, rice, and milo are desirable as "hot foods" for migratory waterfowl, cooperative farmers are asked to plant these crops for the refuge share.

Currently, 9,600 acres of small grain crops are planted on refuge lands except Mathews Brake NWR. Assuming a 25 percent refuge share, 2,400 acres would be available to provide small grain crops for waterfowl. This exceeds the NAWMP 1,022-acre goal for ducks; however the Waterfowl Focus Group identified an additional objective of 1,200 acres of unharvested grain crops for geese, bringing the total unharvested grain crop minimum objective to 2,222 acres (1,022 NAWMP for ducks, and 1,200 Waterfowl Focus Group for geese).

Objective 1D.1. Waterfowl: Complex-wide, provide 2,860 acres of agricultural crops and moist soil for ducks, and on Yazoo NWR provide 1,200 acres in agricultural grain crops, green browse, and moist soil to overwinter migratory Canada, white-fronted, and snow geese.

Yazoo NWR is the only refuge in the Complex with both key habitat and consistent historical use by geese. Geese typically prefer large open areas (1,200 acres) for feeding and resting (personal conversation, Don Orr 2000). Historically, the refuge supported Canada and white-fronted geese by providing winter grazing and "hot foods." To meet the NAWMP and Waterfowl Focus Group's identified minimum objectives, 1,022 acres of unharvested grain crops are needed to support ducks and 1,200 acres of unharvested grain crops and green browse are needed to support goose needs. The Waterfowl Focus Group identified target populations of Canada, white-fronted, and snow geese 2,000, 8,000 and 10,000, for each species, respectively.

However, additional acreage (> the 2,222 acres identified above) is needed to compensate for loss of grain crops consumed by overpopulations of snow geese. (The 2003-2004 waterfowl surveys on Yazoo NWR identified peak populations of 200 Canada, 8,000 white-fronted, and 250,000 snow/Ross' geese.)

Strategies:

- Provide a minimum of 1,022 acres of hot foods (rice, corn, milo) and 4,505 acres of moist-soil habitat to meet the duck use day objectives for refuges within the Complex.
- Provide a minimum of 1,200 contiguous acres in agricultural grain crops, green browse, and moist soil on Yazoo NWR to overwinter 10,000 snow geese, 8,000 white-fronted geese, and 2,000 migratory Canada geese.
- Maintain open areas of sufficient size (> 1,200 acres) and shape that promote goose use.
- For each refuge with cropland goals, employ one Refuge Operations Specialist or Biological Technician, GS-7/9, to manage the farming program.
- Continue to work with Natural Resources Conservation Service to improve Best Management Practices to address siltation, contaminants, and other off-refuge impacts.
- Give highest priority to retaining those fields that can be flooded, are within waterfowl sanctuary areas, do not contribute to linking or creating interior forest habitats, are not easily disturbed when waterfowl are present, or have a history of good production and high duck use. Redistribute habitat objectives, where appropriate, throughout the Complex using the example criteria in Table 12.
- Work with the LMVJV to determine optimum unharvested crop acres (currently under evaluation). Until the optimum acreage objectives are established, exceed minimum acres to compensate for grain losses due to non-target species (e.g., deer, raccoon, and blackirds).
- Convert farm acres above the optimum level to other habitat types to fulfill moist-soil objectives, and to meet habitat needs of waterfowl, other federal trust species, and native fish and wildlife.
- Expand hunting opportunities for snow geese in support of the "Arctic Tundra Habitat Emergency Conservation Act" and to reduce the overabundant populations that are damaging habitat and agricultural lands.

Objective 1D.2. Raptors: Within 5 years of CCP approval, provide 10 miles of native vegetative buffer at least 30 feet wide adjacent to cropland fields.

Strategy:

- Develop new buffer strips and manage existing buffer strips along refuge agricultural fields and roadsides a minimum of 30 feet wide to increase habitat for small mammals and birds.

Sub-Goal 1E. Forest lands – Conserve, manage, and enhance forest lands on all Complex refuges for the benefit of native wildlife species.

Discussion: Bottomland hardwood forests provide a complex of habitats including temporarily and seasonally flooded bottomland hardwoods, and permanently and semipermanently flooded shrub and wooded swamps. Prior to settlement, the LMRAV contained over 24 million acres of bottomland hardwood forests that supported a wide variety of wildlife species. Today, over 80 percent of the original forests have been cleared for agriculture, transportation, industrialization, and urbanization. Most of the remaining 4.8 million acres is composed of numerous isolated habitat islands in a sea of agriculture.

"Forested wetlands provide food resources in the form of mast (nuts and acorns); therefore, mast production is an important and vital component of habitat management. Site characteristics often limit the extent to which managers can increase mast production in existing forest stands because red oaks (the tree type that produces optimal mast) occurred on high sites that were historically cleared. Lower-lying forest stands dominated by overcup oak and other water-tolerant species cannot be managed for red oaks because of excessive flooding or soil saturation. Poor soil drainage also limits crop production as an alternative on these sites, but may be compatible with moist-soil management unless flooding is severe enough to damage levees and water control structures" (Reinecke et al., 1989).

"The length of time needed to restore or alter the species composition of forested wetlands can be problematic because public agencies often acquire bottomland hardwoods tracts that have been managed with little concern for future stand compositions. A minimum of 20-30 years is needed to restore acorn production on these sites, assuming adequate seed sources are available and efforts are made to encourage the growth of oaks" (Reinecke et al., 1989).

"Historically, mallards wintering in the MAV satisfied most of their habitat requirements in forested wetlands. Given the original extent of bottomland forests, mallards probably found abundant food, especially acorns, and favorable water conditions somewhere in the MAV during most winters. A complex of natural habitats enabled mallards to feed on acorns and invertebrates in flooded forests or on seeds of moist-soil plants in beaver swamps and slough margins, to roost and court in more open marshes and sloughs, and to escape predation and social harassment in shrub swamps" (Reinecke et al., 1989).

"Continued management of forested wetland complexes provides valuable habitat for waterfowl and a variety of other wildlife species. However, forested wetlands no longer afford complete winter habitat for mallards. Forested wetlands provide excellent wildlife habitat with low management costs, but food production for waterfowl is limited. When mast production fails locally, there are not enough alternative bottomland hardwood sites remaining for mallards to find sufficient food elsewhere. Consequently, management of forested wetlands should be integrated with other management methods that provide alternative foods, such as croplands and moist soil" (Reinecke et al., 1989).

Objective 1E.1. Forest Management: Over the life of the CCP, manage a minimum of 42,000 acres of mature forest for native resident and migratory species.

Discussion: The alluvial valley of the Mississippi River, characterized by ridge and swale topography, is one of the most unique and productive hardwood and wildlife habitats on the continent. A few feet change in elevation can mean the difference between a baldcypress swamp in standing water and a swamp chestnut oak-cherrybark oak type forest growing on the ridges. The timing and duration of flooding generally determines the type of vegetation, animal species, and biological system functions.

Ridge and swale topography extends from Yazoo NWR (which contains an old oxbow of the Mississippi River) to the loess bluffs on Morgan Brake and Hillside NWRs. Important mast species (willow oak and water oak) are found predominantly in overflow areas of the basin. Other species include sycamore, sweetgum, green ash, American elm, cedar elm, sugarberry, Nuttall oak, black locust, honey locust, overcup oak, bitter pecan, sweet pecan, black willow, and cottonwood.

A rich understory of grasses, herbs, and soft-mast plants are associated with forests of the area. However, some stands are almost devoid of understory plants due to the water regime and crown closure, which shades the forest floor. This is clearly demonstrated at Panther Swamp NWR, where most of the east side of the refuge floods every year and the understory is sparse.

Widely different from forest species of the alluvial valley, are those of the loess bluff. The loess bluff habitat on Hillside and Morgan Brake NWRs contains mostly upland forest trees including white oak, swamp chestnut oak, hickory, Florida maple, American beech, and hornbeam. Understory species include red buckeye, jack-in-the-pulpit, mayapple, Christmas fern, green dragon, and a variety of other wildflowers.

To date, the only active forest management on the Complex is on Panther Swamp NWR, which contains approximately half of the Complex's total forestland. The Panther Swamp NWR Forest Management Plan was drafted in the early 1980s and was developed to guide forest management activities through 2005. Implementation is behind schedule due to staff shortages. Forest management plans on all the remaining refuges will be developed and implemented as resources become available.

During the 1990s, agricultural land reforestation was a priority for the Complex. The Complex contains approximately 42,000 acres of forest, not including reforestation areas. Most of the forested acreage consists of mid- to older-aged woodlands. Many of the older trees are cull remnants from logging that occurred prior to refuge establishment. Overall, the forests contain a mixture of even- and uneven-aged stands resulting from past burning, grazing, timber harvest, and other disturbances.

One goal is to create and manage for older-aged type conditions within several of the current mid-aged stands. In these stands, single-tree selection, group selection, and 1- 3-acre patchcuts will be implemented on the ridge sites to provide a more complex forest stand structure that contains large tree crowns interspersed with openings to promote vertical structure. This will not only benefit neotropical migratory birds, but most fauna of the area.

On the east side of Panther Swamp NWR in areas of unique red oak flats, regeneration cuts will be used on areas up to 10 acres in size. These larger cuts will provide additional sunlight to the forest floor to improve red oak regeneration. Although this even-aged harvest method of regeneration does not initially produce vertical structure, over time other 10-acre clearcuts established every 15 years adjacent to these cuts will produce an all-age forest of even-aged blocks. Various stand manipulations will enhance habitat conditions across the Complex, and meet the requirements for all wildlife species on the refuge.

Up to 5 percent of the forests on Panther Swamp NWR will be designated as an old growth and No-Cut/Management Zone. The avian and old growth habitat relationships should exhibit relatively self-sustaining and preferred habitat characteristics that support priority songbird species found in the LMRAV, such as the Cerulean warbler. As a complex canopy structure develops and tree fall gaps occur, super-dominant trees will be present and patches of dense understory can emerge. Areas of dense understory will provide suitable habitat for species such as the Swainson's warbler. The No-Cut/Management Zone will also be used as a future natural area research site.

Strategies:

- Develop and implement a Forest Habitat Management Plan for the Complex, utilizing the existing 1995 Panther Swamp Forest Management Plan and Goelz 1995, A Stocking Guide for Southern Bottomland Hardwoods, in the interim.
- Complete stand inventory and mapping to build GIS database of forested habitat.
- Maintain records on silvicultural practices, stand growth and development, and stand health.
- Acquire commercial timber harvesting machine to allow Complex staff to conduct mechanical thinnings (timber stand improvement practice) in areas that are not viable for commercial harvest (e.g., reforestation areas and GTRs).
- Maintain red oak component on appropriate sites.
- In patch cuts and regeneration cuts, all stems should be cut down to the 1-inch class.
- Prior to the placement of patch cuts, determine if adequate oak regeneration is present using currently accepted techniques.
- Conduct small regeneration cuts (10 acres or less), shelterwoods, and select harvests (single-tree and group selection) on Panther Swamp NWR, including ridge sites, to increase species and age diversity, and to perpetuate the red oak component, as appropriate.
- Set aside up to 5 percent of the existing forest on Panther Swamp NWR as a No Cut/Management Zone to create an old growth forest for wildlife and to create a future natural area research site.
- Continue to implement the Panther Swamp NWR Forest Management Plan. Ensure that two 1,000-acre compartments will be treated (cruised, marked, and manipulated, as per prescription) annually for the next 15 years.
- Work with adjacent landowners and the state to eradicate and prevent further spread of kudzu along the bluff areas of Morgan Brake and Hillside NWRs.
- Restore appropriate hydrology to remnant stands of bottomland hardwoods by blocking select drainages.

Objective 1E.2. Reforestation Program: Ensure that 21,000 acres of planted forest is managed to produce forest with structure and wildlife diversity.

In 1992, a Complex Reforestation Plan was developed. To expand existing forests and create a contiguous forest interior, over 21,000 acres have been replanted and are interspersed with lakes, wetlands, and other habitats. This diversity of habitats will provide optimum habitat and refuge to resident and migratory wildlife. The oldest reforestation areas are located on Yazoo NWR (planted in 1968) (Table 14) using both seedlings and direct-seeding techniques. Reforestation will continue as directed by the 1992 Reforestation Plan, although most areas identified by this plan have already been reforested. Following reforestation, approximately 3,000 acres were re-planted to ensure a timber stand. Some areas were re-planted three times.

Reforested areas with poor survival may be allowed to undergo natural succession to ensure that an adequate amount of scrub/shrub habitat is available for the painted bunting, white-eyed vireo, American woodcock, and other species. Heavy-seeded species such as oak and pecan will continue to be a large component in future plantings. As more options become available, a diverse species mix will be used in future plantings. Generally, heavy seeded species are more difficult to establish, while light-seeded species in close proximity invade naturally. At least 20 tree species have been planted on refuge lands, including persimmon and baldcypress. However, many of the initial reforested areas consists primarily of oak species. Reforestation will continue as lands that contribute to core forest development become available or other opportunities arise.

Table 14. Reforestation shown in 10-year increments by acreage per refuge and Farm Service Agency tracts

Management Area	1968	1973-1982	1983-1992	1993-2002	Total
Yazoo	50.3	400	720.6	153.5	1,324.4
Panther Swamp	0	0	268.8	1,492.6	1,761.4
Hillside	0	287.6	632.5	578.2	1,498.3
Morgan Brake	0	0	724.8	579	1,303.8
Mathews Brake	0	0	131	55	186
COE Lands	0	0	425	5,766	6,191
Carter Tract (northern unit of Panther Swamp)	0	0	0	1,457	1,457
Other Farm Service Agency	0	0	1,152.8	6,294.50	7,447.3
Total	**50.3**	**687.6**	**4,055.5**	**16,375.8**	**21,169.2**

To help stratify forest canopies and produce stands that support priority bird species, light-seeded species such as sweetgum should be added. Cottonwood and sycamore should be used to produce super-dominant trees. Single-tree selection, group selection, and small patchcuts or pre-commercial thinnings will be incorporated to modify reforested stands to allow sunlight to reach the forest floor and encourage the growth of herbaceous understory.

Strategies:

- Use pre-commercial thinning techniques including felling machinery, dozer, herbicide injection, and firewood harvesting to create diverse habitat.
- Thin reforested stands at crown closure (after approximately 15 - 25 years).
- Establish firelanes around reforestation areas until fuel levels are depleted due to crown closure (approximately 15 - 25 years).
- Add light-seeded species (e.g., ash, elm, and sweetgum), to all future planting mixes.
- Create forested buffers along riparian areas to intercept siltation and contaminants from agricultural runoff.
- Create forested screens along roads and wetlands to reduce disturbance to wildlife and prevent illegal hunting.
- To prevent encroachment and define refuge boundaries, survey and reforest borders adjacent to private agricultural lands, where appropriate.
- As habitat objectives are reevaluated for wintering waterfowl and other priority waterbirds, seek opportunities for reforestation that would contribute to the creation of interior forest habitat.

Objective 1E.3. Carbon Sequestration: Establish partnerships with industry, organizations, and other entities interested in restoring forests for carbon sequestration.

As part of the U.S. Department of Energy's (DOE) three-part approach to managing carbon emissions, forest management practices that sequester carbon have been initiated and funded by energy companies on private and public lands. Since this program began, most efforts have focused on bottomland hardwood reforestation on marginal agricultural areas in the LMRAV. The Southeast Region of the Fish and Wildlife Service has entered into a number of partnerships with the energy industry. To date, 55,646 acres have been reforested in the Region, and over 11,000 of those acres have been added to the Refuge System. Although this program has been voluntary in the past, predictions are that energy companies will be required to mitigate their emissions through this and other DOE programs in the future. Opportunities may arise to partner on projects and possibly receive donated lands for protection. The Complex will actively pursue partnerships with corporations that are participating in the carbon sequestration program to acquire the resources needed to meet reforestation and interior forest objectives, and to address national, regional, and ecosystem goals.

Strategies:

- Focus partnership efforts within the identified Migratory Bird Conservation Priority Zones (Figure 3).
- Work through the carbon sequestration program and develop partnerships with landowners, non-governmental organizations, and other state and federal agencies to reforest certain lands within the Migratory Bird Conservation Zone priorities, giving the highest priority to those lands adjacent to existing and interior forests.
- Develop proposals which identify priority reforestation areas on the Complex, and present proposals to interested partners.

Objective 1E.4. Greentree Reservoirs: Manage approximately 4,000 acres of forest as green tree reservoirs on Complex lands.

Discussion: Several species of waterfowl rely heavily on flooded forested habitat in winter for resting and foraging (acorns, fruits, various seeds, and invertebrates). Wood ducks seek these habitats

almost exclusively over other habitats. Mallards, gadwall, and wigeon all use flooded forested habitat as one of a complex of preferred habitats. In the absence of naturally flooded bottomland hardwood forests, GTRs can artificially produce habitat that mimics naturally flooded forested habitat. Yazoo NWR has the greatest management capabilities for GTRs, and currently manages several for duck habitat during the wintering period. Panther Swamp NWR enhances natural winter flooding during the duck season with water control structures.

Appropriate and effective water management and red oak species perpetuation are keys to a successful GTR. Ideally, GTRs should be flooded only during the dormant period specific to common deciduous hardwood trees in each impoundment. Flooding should never occur before the dormant period starts in late fall (mid-November to late-December) and only rarely after dormancy breaks in the spring. Flooding dates and duration should be varied annually, and periodically the GTR should not be flooded. Poorly managed water levels resulting in deep water (>18 inches) provide little benefit to waterfowl and will eventually kill trees in the GTR or convert the forest to more water tolerant species typical in a deeper water habitat (Greentree Reservoir Management, Fredrickson et al., 1992).

Strategies:

- Install gauges to monitor water levels.
- Use GIS technology to map and quantify GTR acreage.
- Flood GTRs 1 out of 3 years, varying dates and duration annually.
- Flood GTRs no earlier than late November and de-water entirely by March 15.
- Underplant red oaks in the forest stand or encourage natural regeneration on 1- to 5-acre openings on a 10- 15-year cutting cycle.
- Modify GTR management actions to meet waterfowl needs.

Objective 1E.5. Forest Breeding Birds: Over the life of the CCPC, provide a minimum of 20,000 acres of forest interior habitat for forest breeding birds.

Discussion: Refuge forested habitats are predominantly bottomland hardwoods consisting of mature, intermediate, and early successional stages. Panther Swamp NWR has the only large interior forest habitat on the Complex (core 20,000 acres.) Refuge lands in the Complex are located within Bird Conservation Areas, which have been identified for protection and enhancement in the Partners-in-Flight plan. Most refuge lands have also been designated by Audubon as “Important Bird Areas.” Most of the forested land on Yazoo and Morgan Brake NWRs is on the perimeter of the refuge. Opportunities exist for expanding interior forests at Yazoo NWR in partnership with Leroy Percy State Park, government partners, and private landowners. However, reforesting lands inside the refuge would sacrifice valuable moist-soil habitat used by a variety of waterbirds and high calorie food plots needed for wintering waterfowl. On Hillside NWR, siltation is converting the historic bottomland hardwood forest to a monoculture of black willow. Given that the designated purpose of the COE’s Hillside Floodway Project is to capture silt from upland sources, the potential to manage this refuge for forest interior birds is limited.

The priority bird species for the Complex are indicated as follows:

Extremely High - Swainson’s warbler (breeding--nests in dense understory, forages on open, moist ground), swallow-tailed kite (breeding--nests in super-dominant trees, possibly cypress), cerulean warbler (breeding--nests and forages in canopy of sawtimber trees);

High - Prothonotary warbler (breeding--cavity nester, usually in trees over open water), red-headed woodpecker (breeding--cavity nester), northern parula (breeding--canopy, usually with spanish moss), Kentucky warbler (breeding--nests in patches of dense ground cover), yellow-billed cuckoo (breeding--nests in midstory and canopy), wood thrush (breeding--midstory, forages on moist ground), American woodcock (forages on open, moist ground but under very dense understory cover), black duck (wintering - open water).

Moderate - Wood duck (breeding--cavity nesting over or near open water), acadian flycatcher (breeding--open midstory), eastern wood-pewee (breeding--open canopy), Carolina chickadee (breeding--cavity nester), Mississippi kite (breeding--nests in trees along edges in open country), Baltimore oriole (breeding--scattered hardwoods in open country), ruby-throated hummingbird (breeding--woody vegetation in moist habitats, usually near tubular flowers), blue-gray gnatcatcher (breeding--mature and moist hardwood forests), hooded warbler (breeding--dense understory), bald eagle (breeding--nests in super-dominant trees large enough to support massive nests), rusty blackbird (wintering--winter roost in canopy, forages on the ground).

Local or Regional Interest - Yellow-throated warbler (breeding - canopy, usually with spanish moss), American redstart (breeding - hardwood forests, usually near water), yellow-throated vireo (breeding - open canopy), summer tanager (breeding - open canopy), pileated woodpecker (breeding - mature and extensive forest, with dead trees for nesting).

Strategies:

- Develop and implement a forest management plan designed to maintain a diversity of tree species compositions, tree age class distributions, and structure for forest interior birds.
- Cooperate with state and federal agencies, non-governmental organizations, conservation organizations, and private landowners to connect forest at Panther Swamp NWR with Lake George and Delta National Forest, and examine additional opportunities to link forest lands with other refuge lands to increase the core area and provide travel corridors.
- Develop and maintain GIS databases to monitor forest restoration progress and forest stand management results.
- Employ one full-time forester on Panther Swamp NWR, one full-time forestry technician for the Complex, and three seasonal forestry technicians to manage refuge forest lands.

Objective 1E.6. Threatened and Endangered Forest Species (Louisiana black bear, pondberry, bald eagle, ivory-billed woodpecker): Contribute to the recovery of threatened and endangered forest species on the Complex, as well as on other public and private lands situated in the lower Mississippi Delta.

Discussion: The only known federally listed threatened or endangered species that occur in or potentially use forests on the refuge are Louisiana black bear, pondberry, and the bald eagle.

Louisiana black bear:

The Louisiana black bear is listed on the Endangered Species List as a threatened species. Louisiana black bears historically occurred throughout the south half of Mississippi and were reportedly common in the LMRAV. Habitat loss through lands conversion to agricultural fields and excessive harvest throughout their range have greatly reduced black bear populations.

Strategies:

- Provide den habitat by protecting existing and potential den trees (trees that may someday develop a cavity above the flood line large enough to accommodate a bear). Also, create den areas by developing dense thickets and leaving felled treetops or brush for ground nesting cover on areas of higher elevation, where possible, especially in areas lacking in ground cover above the 10-year flood zone.
- Provide habitat to support the recovery of the Louisiana black bear by providing a mix of hard- and soft-mast producing species for year-round foods.
- Identify opportunities to create interior forested habitat and forested corridors by linking remnant forested habitats on state, federal, and private lands needed for any future reintroduction efforts of the Louisiana black bear. Projects will be completed through partnerships or land acquisition from willing sellers.
- Participate in repatriation efforts for the Louisiana black bear at Panther Swamp NWR and other lands situated in the lower Mississippi Delta.
- Provide education and training on black bear to the public, as well as Complex personnel. This training may be in the form of school programs, landowner workshops, posted signs, and pamphlets.
- Train Service personnel in bear relocation and human/bear conflicts. Complex personnel will be encouraged to work with state bear restoration groups and others to accomplish this goal.

Pondberry:

Pondberry is a rare shrub that grows in seasonally flooded wetlands and on the edges of sinks and ponds. Much of the land on which pondberry was historically found has been converted to agricultural fields. Wetland drainage and timber harvests have also reduced pondberry populations.

Strategies:

- Work with Jackson, MS, Ecological Services Office to identify pondberry colonies on Complex lands.
- Provide suitable habitat for additional pondberry introductions.

Bald eagle:

Bald eagles breed aerially and nest in super-dominant trees that are large enough to support massive nests. Bald eagles are becoming more frequent sightings throughout the Complex and nesting has been documented in Lake Washington only two miles from Yazoo NWR.

Strategy:

- Encourage the growth of super-emergent trees at the edges of lakes and streams to provide nesting habitat for the bald eagle.

Ivory-billed Woodpecker:

The ivory-billed woodpecker is North America's largest and rarest woodpecker and until recently was believed to be extinct. Prior to the recent rediscovery of the ivory-billed woodpecker at Cache River NWR in Arkansas, there had been no confirmed sightings of this bird in more than 60 years. There is currently no evidence that the ivory-billed woodpecker exists on the Theodore Roosevelt NWR Complex, however, habitat conditions that may support this species are likely to improve over time with respect to both larger areas existing and being reforested (Panther Swamp NWR, in particular), and habitat structure through a variety of active and passive forestry activities.

Strategy:

- Future actions would be based on recovery plan efforts currently being developed. In the interim, continue to manage for large tracts of old growth hardwoods at Panther Swamp NWR.

Objective 1E.7. Wild Turkey: Provide habitat diversity to include mature bottomland hardwoods, scrub/shrub, and grasslands sufficient to support 300-500 birds.

Discussion: Turkey populations reached an all-time low in the early 1900s due to excessive hunting, domestic poultry diseases, and habitat destruction. Recently, turkeys have made a comeback largely due to extensive restocking efforts. Current population estimates for Mississippi range from 250,000 to 300,000 birds. Wild turkeys must have suitable food, shelter, nesting, and brooding places, and minimal disturbance. Their habitat requirements are more specific than for other forest species, such as deer, which can adapt to a broader range of conditions. Turkeys spend most of the year in flocks, so habitat must be sufficient to support a flock rather than just a few individual birds. Wild turkeys are birds of the forest during the winter and are found in field margins, cutover areas, and openings during the summer. Adequate, uneven-aged forestland interspersed with openings that can provide diverse food sources, brood rearing habitat, edges for nesting, and room for courtship is important. Openings (old fields, cropland, pastures or early successional scrub/shrub habitats) work well, but turkeys will use also use power lines, pipelines, levees, roadsides and rights-of-way.

Due to their particular requirements, woodland changes influence wild turkeys more than other forest game species. Bottomland hardwoods have the capability of producing large amounts of hard mast, an important food source for turkeys. Forest management practices, including selective improvement harvest, thinning, and group select cuts provide important habitat needs. Good turkey habitat includes mature mast-producing hardwoods (mostly oaks), smaller hardwoods, and a mixture of understory plants, such as dogwood and cherry. Because young turkeys need a high protein diet in the form of insects, good habitat also contains insect-producing areas, such as small openings, agricultural fields, pastures and roadsides, as well as easy access to water.

Strategies:

- Develop and maintain habitat emphasizing hard and soft-mast producers, such as oak, pecan, dogwood, wild cherry, grapes, and berries for year-round food sources.
- Maintain fire lanes around reforested areas to encourage growth of native seed- producing plants.
- Maintain permanent openings (grasslands), including roadside, power line, and gas line rights-of-way, to provide nesting and brood cover and a diversity of foods, such as seeds and insects.

- Work with the COE to delay levee burning and mowing on Panther Swamp and Hillside NWRs until July to provide nesting, brooding, and foraging habitat.

Sub-Goal 1F. Scrub/Shrub Habitats – Establish and maintain scrub/shrub habitats on the Complex.

Discussion: Scrub/shrub habitat is particularly important for ground-nesting birds, and for cover and refuge for a variety of migratory songbirds. Of the seven refuges in the Complex, Yazoo NWR is best suited for the establishment and maintenance of scrub/shrub habitat. Habitat management efforts will focus on important wildlife species that rely on scrub/shrub habitats for breeding, foraging, nesting, and cover.

Objective 1F.1. Woodcock: Within 5 years of CCP approval, provide a minimum of 125 acres of moist mid-story (scrub/shrub habitat) and ground-story vegetation (thickets) for daytime cover and foraging habitat and for nighttime foraging habitat, contribute a minimum of 250 acres in 5- to 20-acre blocks of open habitat in moist croplands and grasslands near scrub/shrub areas. Specific sites will be determined through surveys and research.

Discussion: Woodcock are migratory game birds that inhabit forested areas in the eastern United States and feed on earthworms. Woodcock populations in the Central Region, where the Complex is located, have declined 19 percent since 1968. Population declines are thought to be due to land-use changes associated with land conversion and to the maturing of forest habitats. Although woodcock use a variety of habitat types (scrub/shrub, mid-story forest, grasslands, and croplands), scrub/shrub habitat is the limiting factor for reproduction success, because woodcock move to open or brushy fields at dusk to forage and conduct courtship activities throughout the night. Wintering habitats include moist bottomland hardwood forests with underlying brush and understory in close association with agricultural fields. Preferred sites are typically wet thickets (e.g., privet, cane, briars) with a high density of plant stems and clear, open ground.

In 1990, the American Woodcock Management Plan set an objective to protect and enhance winter and migration habitat on public lands to increase woodcock carrying capacity. The plan also set objectives to inventory and monitor woodcock habitat and develop management demonstration areas. The following strategies have been identified for habitat management.

Strategies:

- When and where appropriate conduct timber stand improvement in areas to help develop a thicker under-story/mid-story component of saplings and seedlings conducive to nongame bird groups and woodcock.
- Preserve all “cane” habitat areas and create/maintain scrub/shrub wetlands and uplands preferred by this species. Investigate opportunities to restore cane brakes.
- Maintain 50 acres of grasslands near scrub/shrub habitat.
- To meet objectives of the Complex, provide woodcock roosting and foraging habitat near agricultural areas that are not fall disked.
- Develop woodcock habitat demonstration sites on the Complex.

Objective 1F.2. Nesting Scrub/Shrub Birds: Provide and maintain a minimum of 1,500 acres of scrub/shrub habitat for nesting birds.

Discussion: Scrub/shrub (early successional) species are also considered vulnerable in the southeastern United States, although they are generally considered a lower priority than mature forest species within the LMRAV. During reforestation, when trees are maturing, some scrub/shrub species will benefit from the early successional habitat provided in forest lands during early phases (especially white-eyed vireo, painted bunting, and orchard oriole). Conversely, an extensive edge habitat with elevated numbers of nest predators and brown-headed cowbirds may interfere with a healthy and complete forest breeding bird community until reforestation efforts are well advanced. Because scrub/shrub species are apparently able to withstand cowbird and depredation problems better within smaller blocks of habitat (i.e., 50-100 acres, possibly as small as 25 acre patches), sites will be selected for periodic disturbances and long-term maintenance.

Priority Species:

- High - Painted bunting (breeding--dense thickets of shrubs, saplings, or second-growth trees), white-eyed vireo (breeding--dense, and usually moist thickets), Bell's vireo (breeding--streamside thickets or upland scrub oaks), orchard oriole (breeding--scattered hardwood trees in open country);

- Moderate - Yellow-breasted chat (breeding--dense cover of shrubs or saplings), northern bobwhite (breeding--ground-nester), field sparrow (wintering).

Strategies:

- Maintain existing early successional habitats along buffer strips to scrub/shrub habitat (vegetation no more than 20 ft. high) by plantings, disking, chemicals, or burning.
- Convert additional agricultural lands throughout the Complex to scrub/shrub (early successional) habitat to meet a 1,500-acre goal for priority scrub/shrub breeding species. Plant species such as native plum, rough-leaf dogwood, devil's walking stick, deciduous holly, and hawthorn.
- After 5 years of surveys, consider more involved protocols to address not only species occurrences, but also relative rates of reproductive success and/or post fledging survival in response to management protocols, with focus on painted buntings, white-eyed vireos, and orchard orioles.
- Monitor bird response over 15 years to determine success for attracting priority breeding species. If success is low or habitat maintenance is too costly, reforest the scrub/shrub areas with plantings, or by allowing natural regeneration.

Objective 1F.3. Bobwhite Quail: Provide up to 500 acres of suitable habitat Complex-wide.

Discussion: The northern bobwhite traditionally has been one of the most valued game birds in the South. Around the turn of the twentieth century, bobwhite numbers reached all time highs, but have since begun a constant decline. Changes in agricultural practices that create large monoculture farms with relatively few vegetated field borders and ditches have compromised quail habitat, and declining areas of habitat in other areas have adversely affected quail populations. Bobwhites do not forage well in leaf litter nor maneuver easily through thick brush. Virtually all of the bobwhite's food and cover requirements are met in habitat with a layer of seed-producing vegetation within 3 feet of the ground. Forests with closed canopies that do not support understory vegetation do not provide adequate habitat.

Although remnant populations of birds in the Complex are expanding with reforestation projects, more opportunities exist to combine their habitat needs with those of federal trust species, such as grassland migrating birds, where management programs will benefit a diversity of wildlife. Permanent forest openings can be vital for providing adequate brood and nesting cover and a diversity of foods from grass seeds to insects. Roadsides, power lines, and gas line rights-of-way can all effectively provide these openings in the forest. Generally, the higher percentage of forest land that can be maintained in permanent openings, the better the habitat.

Quail habitat can be provided on agricultural lands if certain factors are considered, including crop type, field size and shape, chemical usage, and the condition of idle areas such as buffer strips and ditches. Preferred crops include corn, soybeans, and wheat, with the outer rows left unharvested.

Strategies:

- Evaluate all refuges in the Complex for suitable grassland habitat sites that could be managed for a variety of grassland species.
- Develop and maintain a minimum 30-foot-wide buffer adjacent to selected agricultural fields.
- Within those fields managed for quail, maintain 15-20 percent woody cover, 10-15 percent fallow areas, 15-20 percent grassy areas, and 40-60 percent row crop (Mississippi State University Extension Service). Woody cover should be available every 200 yards.
- In the spring, lightly disk 30 percent of grassland fields to disturb soil and vegetation, set back succession, expose bare soil, and promote seed-producing plants.
- Lightly disk firelanes surrounding forested stands to encourage the growth of legumes, attract insects, and create a mosaic of bare ground and vegetation that provides feeding and brood-rearing cover.
- Monitor population responses to quail management practices.

Sub-Goal 1G. Provide grassland habitat for high and moderate priority grassland birds.

Discussion: Priority grassland species occupy refuge lands primarily during migration periods and winter, although a few species may breed in small numbers throughout the year. Newly reforested areas, levees, archaeological sites, and converted agricultural lands constitute the majority of grassland habitats on the Complex.

Priority Species:

- High-Henslow's sparrow (wintering), sedge wren (wintering), short-eared owl (wintering), LeConte's sparrow (wintering)

- Moderate-Dickcissel (breeding--herbaceous cover where vegetation is at least 2 feet [0.6 m] high), northern bobwhite (breeding--ground-nester), loggerhead shrike (breeding and wintering--tree or shrub nesting, forages from a perch), field sparrow (breeding--scattered saplings, shrubs, and tall herbaceous cover; wintering--dense cover of herbs, particularly tall composites), northern harrier (wintering), grasshopper sparrow (wintering), field sparrow (breeding and wintering in abandoned fields).

Objective 1G.1. Maintain existing and create a minimum of 500 acres of open grassy-herbaceous dominated ground conditions to support priority grassland bird species.

Strategies:

- Identify poorer quality sites with sandy soils and promote the development of grassy-herbaceous ground cover (Andropogon spp.) on up to 500 acres.
- Maintain diverse habitat in the grassland stage by burning, mowing, disking, using appropriate herbicides, and select plantings.
- Request that the COE delay levee mowing and burning on Panther Swamp and Hillside NWRs until July.

GOAL 2. CONTROL AND MANAGE INVASIVE, PEST, AND NUISANCE SPECIES

Discussion: Numerous native and non-native invasive species are known to occur on refuge lands in the Complex, and some have caused damage to important wildlife habitats or species. Feral swine on Morgan Brake, Mathews Brake, Hillside, and Panther Swamp NWRs destroy habitat by rooting up vegetation and trees in forests and depleting acorn mast, a preferred food for waterfowl and other native species. They destroy levees and crops. These species can transmit diseases, such as pseudorabies, to other wildlife. In addition, Complex lands have populations of nutria, armadillo, coyote, alligator weed, and kudzu.

In many areas of Mississippi, double-crested cormorant populations are at an all-time high. Currently, the cormorant has not been identified as either an invasive species or a nuisance species on refuge lands. Commercial aquaculturists (especially catfish farmers) suffer economic losses due to cormorant depredation on catfish ponds. Similar problems have been reported from white pelicans. In 1988, of 281 catfish farmers queried in the Mississippi Delta, 87 indicated that they had a bird problem. Fifty-seven percent of Delta farmers reported moderate to heavy cormorant activity (defined as at least 25 birds/day). Catfish farmers reported losses (harassment costs plus the value of lost fish) estimated at $5.4 million (3 percent of total sales) (U.S. Fish and Wildlife Service 1997). Although cormorant depredation was not an issue identified by the Service or the public, soaring cormorant populations in an area with numerous catfish farms are likely to produce economic losses.

Objective 2A - Invasive Species: Control or eradicate invasive species on all Complex lands.

Discussion: Feral swine impact crops planted for waterfowl and negatively alter a variety of habitats, including reforested lands. An on-going feral swine eradication program is conducted on Panther Swamp and Morgan Brake NWRs. Armadillo have invaded refuge lands, but the impacts of their presence have not been extensively studied. Coyotes have virtually eliminated gray fox and red fox on refuge lands. Alligator weed, bull thistle, Johnsongrass, sicklepod, and kudzu have also displaced native plant species on refuge lands.

Strategies:

- Develop an Invasive Species Management Plan by 2006, that includes management guidelines (e.g., contracts, special use permits, and special conditions) for trapping or other invasive control programs consistent with sound biology, Service guidelines, and refuge purposes.
- Consistently implement a feral swine and nutria control program using a variety of techniques, including sustained baiting, trapping, and lethal means. Conduct only controlled removal by Service personnel. Note: no public hunts would be established for feral swine because that would produce an incentive for the continued release of domestic swine on refuge lands.
- Encourage adjacent landowners to dispatch feral swine on private lands.

- Employ one full-time GS-7 biological technician and one term (six-month) GS-5 biological technician to conduct a Complex-wide Invasive Species Management Program.
- Develop strategies for controlling invasive plants on refuge lands.
- Develop strategies for controlling or eradicating populations of coyote and armadillo.

Objective 2B - Pest and Nuisance Species: Reduce populations of nuisance species to non-destructive levels.

Discussion: Nuisance species are terrestrial or aquatic plants or animals that interfere or threaten to interfere (at an unacceptable level) with the attainment of refuge objectives, or that pose a threat to human health. Currently, several species occur on the Complex, which have achieved this status. Beaver, although native, have thrived and overpopulated in bottomland hardwoods because their historic natural predators are now absent or reduced in number. Beavers construct large dams and block water control structures, holding and deepening water. This causes wide-spread damage to trees, and is particularly evident on Panther Swamp NWR, where hundreds of acres of trees have been killed by flooding from beaver dams.

Raccoon and skunk also flourish on refuge lands and surrounding agricultural areas, and as with beaver, they lack natural predators and have become nuisance species. Raccoon and skunks prey upon bird nests and eat crops planted for waterfowl. Over-abundant raccoon populations limit cavity nesting species, often killing the occupant during the nest incubation. They also spread diseases, including rabies.

Snow geese congregate on refuge lands during the wintering season in large numbers, and consume agricultural grains planted for high priority migratory waterfowl. In 2004, more than 250,000 snow geese were observed on Complex lands.

Strategies:

- Continue to use approved biological, chemical, and lethal means to eradicate nuisance species.
- Develop an outreach program to educate the public on the impacts and potential sources of invasive species, and techniques for eradication and control.
- Increase opportunities for raccoon hunting throughout the Complex.
- Remove (by hand, using mechanical means, or with explosives) or alter all beaver dams that are causing undesirable impacts to forested areas. All safety precautions and policies must be met when removing dams, especially when using explosives and removing dams from culverts.
- Use lethal means to control beavers to prevent damage to reforested areas.
- Install effective beaver guards or water diversion devices on all water control structures that are continually disabled by beaver dams.
- Encourage snow goose hunting by providing information in hunt brochures and public contacts regarding goose hunting opportunities on Complex refuges.
- Conduct cormorant and white pelican population management control with USDA Animal and Plant Health Inspection Service in accordance with 50 CFR 21.47, to minimize habitat damage and wildlife displacement.

GOAL 3. EXPAND RESEARCH AND MONITORING ON THE COMPLEX THROUGH PARTNERSHIPS

Discussion: To ensure that management decisions are based on sound science, the Complex's research and monitoring program should be expanded to include additional surveys, selected management studies, and other research needs. Because funding is limited, and the Complex is not staffed as a research station, it is unlikely that all inventory, monitoring, and research needs can be conducted by refuge staff. Therefore, most research and monitoring will be conducted by visiting researchers and scientists. Monitoring protocols, standardized routes, and computerized databases would be incorporated into the research to make inventorying more efficient and produce more consistent results.

Objective 3A - Ensure that management decisions are based on sound science by using research results to apply adaptive management strategies.

Strategies:

- Develop a research and monitoring program to cover priority research needs on all refuges in the Complex, and Farm Service Agency transfer lands.
- Work closely with the Sevice's Division of Migratory Birds' biologists and Lower Mississippi Valley Joint Venture biologists to develop and implement research projects.
- Actively solicit and logistically support research by universities, U.S. Geological Survey, USDA Forest Service, or other research entities to conduct applied investigations to answer management questions and enhance capabilities to provide for target species. This includes providing housing, stipends, research sites, and selected equipment.

Threatened and Endangered Species:

Discussion: Complex lands support Louisiana black bear (T), interior least tern (E), bald eagle (T), and pallid sturgeon (E). Experimental plantings of pondberry, Lindera melissifolia, have been introduced in the Complex to investigate seedling survival in selected habitats. These planted areas are not considered reintroductions and do not constitute naturalized populations.

The Louisiana black bear occurs sporadically on Yazoo NWR, using refuge lands for varying lengths of time. In 2004, a young male black bear was captured on the refuge near Alligator Pond and fitted with a radio collar to track his travels. He remained on the refuge well into the denning season. Visitors reported seeing a sow and cubs and two additional adult male bears as well. As black bear repatriation efforts continue within the historic range in Mississippi, the chances of having a resident breeding population will increase.

Least terns use open water areas for foraging during their breeding and post-breeding periods. Better quality foraging habitat would be helpful to this species, which nests nearby on the Mississippi River. The bald eagle nests in the vicinity of the refuges, but at this point, no nests have been found on any station of the Complex. They occasionally forage on the refuges during the breeding season. Bald eagles from the north migrate to the area and are seen regularly, usually as singles, during the migration season. They are usually associated with large populations of waterfowl in the winter. The pallid sturgeon has never been reported in refuge waters, however, it is reported to occur in the Yazoo River. Overflow water from the Yazoo River backs up into Panther Swamp NWR, and this may provide the opportunity for the pallid sturgeon to use refuge waters during flood events.

Strategies:

- Support the implementation of national and regional threatened and endangered species recovery plans by inventorying the distribution, population status, and habitat use of all threatened and endangered species, candidate species, and species of special concern.
- Participation in repatriation efforts for the Louisiana black bear at Panther Swamp NWR.
- Document all sightings of least terns including activity, habitat, and breeding pairs and report results to the COE biologists monitoring tern populations, as outlined in the recovery plan.
- Monitor and maintain records of sightings of all threatened and endangered species on the Complex, including location and habitat type. Participate in surveys for threatened and endangered species within the Yazoo watershed, including, but not limited to, pallid sturgeon and paddlefish.
- Monitor and record use by least terns in conjunction with International Shorebird surveys.
- Support experimental pondberry research (not related to recovery plan) on the Brown Tract and Hillside and Yazoo NWRs.

Ducks and Geese:

Strategies:

- Prepare a Biological Inventory/Monitoring Plan that includes refuge-specific waterfowl inventory and monitoring protocols, standardized routes, and computerized databases.
- Conduct waterfowl inventories at least twice monthly (October to mid-March) with emphasis on the more visible areas of the refuge where ground/ocular surveys can be made using standard techniques and survey routes.
- Conduct a special August/September survey for blue-winged teal within key wetlands using standardized techniques and routes.
- Monitor periods of use, populations, and species of geese using the Complex.
- After 5 years, evaluate population estimates and species compositions to determine if 1,200 acres of agricultural grain crops will meet the needs of migrating geese.

Wood Ducks:

Discussion: Because wood ducks are secretive, their population status and survival are difficult to monitor using visual counts. Pre-season wood duck banding is the only practical method for estimating wood duck populations, survival, and possibly other population parameters. State banding quotas by sex and age have been established by the Mississippi and Atlantic Flyways and the state quotas have been allocated to various state and federal facilities around the State of Mississippi. The Complex (particularly Yazoo NWR) contributes toward achieving the annual Mississippi pre-season banding quota. The pre-season period extends from July through September. For statistical purposes, all ducks banded during this 3-month period are assumed to have the same survival rate for each age and sex class. In Mississippi, and several other southern states with a special wood duck or teal season, the pre-season banding period ends September 15 to prevent any potential conflicts (i.e., baiting) with hunters.

Wood duck quotas assigned to the Complex are for the pre-season (July to September 15) banding period. In the past, prior to July 1 of each year, the Complex banded 100+ adult hens using trap nest boxes. These ducks are more vulnerable due to nesting and brood rearing and have survival rates lower than those banded later in summer, and therefore are not used for statistics in the banding program. (Early summer banding may occur every 3 years to assess survival rates and return of nesting hens for the refuge.) This presents a problem in that, especially in recent years, it has become extremely difficult to attract wood ducks to bait between July 1 and September 30.

Strategies:

- Expand banding program to include all refuges throughout the Complex, particularly after the wood duck box program is expanded.
- Meet or exceed the preseason (July to September 15) flyway and state banding goal of 400 birds. Emphasize that goals will include the entire Complex.
- Employ two GS-5, 6-month seasonal biological technicians to conduct a trapping and banding program, maintain wood duck boxes, and monitor success throughout the Complex.
- Continue to examine the most effective means of trapping and banding wood ducks, ensuring the objective is met with minimal effort and resources.
- Check wood duck boxes at least three times a year (pre-season, at the end of the first peak of nesting, and at the end of the season). Monthly checks (April through July) are preferable to capture accurate nesting statistics, clean out used nests and dumped eggs for increased hatchability and box use, and monitor predation and other problems.
- Work with universities and researchers to determine other means to increase duckling survival.
- Evaluate nest efficiency and nesting success in boxes and adjust the program accordingly.

Marshbirds:

Discussion: Giant cutgrass, lotus, cattail, rice fields, and moist-soil units are the primary habitats for secretive marshbirds (rails, bitterns, grebes, moorhens, gallinules, coots, and others). Although no specific population objectives have been established, secretive marshbird surveys can be used to track peak movements in and out of the refuge and to document responses to habitat management. Surveys employ a taped playback-response protocol along a designated route for breeding species. The protocols were intended to survey breeding birds, but should also be useful for surveying birds during migration (and winter) as most rails vocalize all year.

Priority species: High – black rail, yellow rail; Moderate – American bittern, king rail, Local or Regional Interest – least bittern.

Strategies:

- Conduct surveys for secretive marshbirds in vegetated, flooded moist-soil areas, flooded rice fields, and permanent impoundments containing rank emergent vegetation in shallow water. Record bird usage by date, location, and habitat type.
- Conduct surveys three times per month (mid-March to mid-April, and mid-August to late-November), on actively managed units to analyze responses to habitat differences.

Colonial Waterbirds:

Strategies:

- Annually locate and delineate colonial waterbird rookeries.
- Survey rookeries at least annually and provide information to the Colonial Bird Monitoring Program administered by the Mississippi Museum of Natural Science.
- Determine foraging areas for white ibis from the White's Lane rookery.
- Beginning May 10 and ending on at least a semi-monthly basis, monitor use of deep-water/moist soil impoundments by wading birds

Shorebirds:

Discussion: Studies are needed on overall shorebird use in the Complex and on peak passage periods for various shorebird species.

Priority Species:

High – stilt sandpiper*, buff-breasted sandpiper, western sandpiper, short-billed dowitcher, and Wilson's phalarope;

Moderate – semipalmated sandpiper*, sanderling, greater yellowlegs, dunlin, common snipe*, least sandpiper*, willet, American avocet, killdeer*.

(*Commonly occurs on the Complex. Others species are present, but usually in low numbers.)

Strategies:

- Conduct shorebird surveys in accordance with International Shorebird Survey protocol at Yazoo and Morgan Brake NWRs and the Carter Tract.
- Determine the optimum acres of shallow-water habitat needed for a rotation scheme to meet shorebird objectives.
- Investigate and research methods of habitat treatment that favor midge proliferation in a shallow-water rotation scheme (shorebird phase).
- Record habitat conditions (including the date that mudflats are exposed) and water levels at least semi-monthly.
- Pursue research opportunities to better understand shorebird management, especially food production and utilization.

Woodcock:

Discussion: Woodcock populations in the Central Region (including the Complex area) have declined 19 percent since 1968. Population declines are thought to be the result of land use changes associated with land conversion and the maturing of forest habitats. In 1990, the American Woodcock Management Plan was completed and an objective set to protect and enhance winter and migration habitat on public lands to increase woodcock carrying capacity. The plan also set objectives to inventory and monitor woodcock habitat and develop management demonstration areas.

Strategies:

- Inventory suitable woodcock wintering habitat (daytime cover areas in scrub/shrub, thickets, and/or early reforestation areas) and nighttime feeding areas (croplands and grasslands).
- Conduct crepuscular flight and nighttime counts at least twice a month, mid-November through mid-March, to assess woodcock usage on the Complex.

Scrub/Shrub Nesting Birds:

Strategies:

- Monitor scrub/shrub fields for use by nesting species using currently established protocol for point counts.
- Monitor bird population responses to habitat restoration using direct and point counts.
- After 5 years of surveys, collect information not only on species occurrences, but also relative rates of reproductive success and/or post fledging survival in response to management protocols, with a focus on painted buntings, white-eyed vireos, and orchard orioles.

Interior Forest Breeding Birds:

Discussion: No comprehensive survey of all forest birds, breeding or migratory, has been completed on the Complex. Therefore, additional information is needed to determine which habitats are most widely used, particularly for high priority species such as Swainson's warbler, prothonotary warbler, red-headed woodpecker, northern parula, Kentucky warbler, yellow-billed cuckoo, and wood thrush.

Strategies:

- Survey all refuges for migratory and nesting forest species.
- Survey forest breeding birds with point counts tied to spatially discrete, geo-referenced, habitat-specific locations to assess the preferred habitat, presence/absence, and relative abundance of all forest-breeding species.
- Report all data to the Lower Mississippi Valley Joint Venture Office Evaluation Coordinator.
- Surveys should be designed using the protocol in Hamel et al., (1996. A Land Manager's Guide to Point Counts of Birds of the Southeast. Gen. Tech. Rep. SO-120. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Research Station. 39 pp.).
- Each point count survey should be conducted annually during mid- to late-May.
- Conduct the point counts in the same sequence from one year to the next (i.e., same direction, and sequence of points within a morning and among mornings), with the same observer, if possible.
- Compare breeding bird productivity in mature forests adjacent to agricultural fields, to those in mature forests adjacent to moist-soil, scrub/shrub or reforested edges.
- After 5 years of baseline data, begin more involved protocols to address not only species occurrences, but also relative rates of reproductive success in response to management.
- Generate a GIS layer that displays geo-referenced survey points by habitat types and associated structure and species distribution and occurrence.
- Collect baseline data and continue annual surveys to monitor breeding bird population responses to habitat restoration and enhancement programs using point counts (breeding birds) and transects (Project Prairie Bird) protocols.

- Establish experimental plots, stratified by age, to determine the best procedures to manage reforestation sites. Emphasize maximizing tree height, and promoting greater availability of cavities while increasing understory structure to benefit both canopy and understory species.
- Establish at least 30 control plots (Complex-wide), emphasizing passive management where only monitoring of bird populations and vegetation occur.
- Establish at least 20 experimental plots each, emphasizing management using single tree cuts and group cuts to reduce basal area.
- Monitor bird population responses to habitat restoration using, at a minimum, point counts, which will include data for both canopy and understory species at each of the plots. Collect pre-treatment data for at least 2 years to establish baseline and continue through post-treatment.

Transient Land Birds:

Discussion: The relative importance (use) of small versus large woodland tracts by landbirds during migration remains unclear, particularly in the highly fragmented LMRAV. These migratory birds are searching not only for protective habitat, but also for food sources, especially fleshy-fruiting shrubs, to meet their high-energy needs.

Priority Species:

Extremely High - Golden-winged warbler; High-- cerulean warbler, blue-winged warbler, bay-breasted warbler, bobolink, Canada warbler, veery, Philadelphia vireo, blackburnian warbler, palm warbler; Moderate - black-billed cuckoo, olive-sided flycatcher, willow flycatcher, least flycatcher, chestnut-sided warbler, black-throated green warbler, mourning warbler.

Strategies:

- Retain and promote fleshy-fruit producing shrubs in all future forest restoration and management techniques.
- Survey the species and abundance of transient land birds that use the Complex and determine the best long-term strategy to maintain adequate stopover habitat for transient landbirds.
- Monitor bird population responses to habitat restoration using transect (migration monitoring) protocols to record timing and extent of transient landbird use.
- Establish at least one 1-mile forested edge transect on Yazoo, Hillside, and Panther Swamp NWRs; and one 1-mile interior forest transect on Panther Swamp NWR. Survey each transect weekly or bi-weekly during both spring and fall migrations. To record the greatest variety of species, establish transects in reforestation plots, scrub/shrub areas, and grassland areas in habitat patches that are large enough to allow for at least a 0.5-mile (~0.8 km) long transect.
- Survey the bird and tree species occupying the loess bluff habitat on Morgan Brake and Hillside NWRs.
- Point counts should be distributed among habitats in proportion to the availability of habitat types, with a minimum of 30 points per habitat type if possible (based on a minimum spacing of 820 x 820 ft (250 x 250 m) (C. Hunter, Biological Review 2001).

Grassland Birds:

Strategies:

- Conduct baseline species surveys.
- Monitor bird responses to management and habitat alterations.
- Survey/inventory/monitor bird populations using point counts and transects (project prairie bird) protocols focusing on breeding and wintering species. Conduct 3-6 surveys per season with at least one or two within each of the following periods: (1) November 15-December 31; (2) January 1-February 15; and (3) February 16-March 10.
- Establish at least one 100-m transect in each discrete patch of habitat in open grassy-herbaceous dominated condition, and use Project Prairie Bird protocol to count wintering bird populations.

Raptors:

Discussion: Northern harrier, loggerhead shrike, and other raptors are best surveyed along an established route (i.e., roadside surveys). Conducting surveys at least twice per month from mid-September to the end of March is recommended for non-breeding populations, including transients (and may include some early breeding for some species). Surveying throughout the year is optional.

Priority Species:

Extremely High - Swallow-tailed kite (migration, breeding - nest in superdominant trees, possibly cypress).

Moderate - Mississippi kite (breeding--nests in trees along edges in open country), loggerhead shrike (breeding--nests in tree or shrub, forages on ground, wintering), northern harrier (wintering), bald eagle (wintering, nesting possible--nests in super-dominant trees large enough to support massive nests).

Strategies:

- Use roadside counts and “Migration Hawkwatch” protocols to institute a network of roadside surveys for wintering and breeding raptors, focusing on priority species.
- Conduct annual National Midwinter Bald Eagle count and report the data to the National Coordinator, Raptor Research and Technical Assistance Center in Boise, Idaho.

Deer:

Discussion: Refuge deer populations are an important component of the biota of the Complex. Consistent population management is key, not only to the public use program, but also to the health of the population and to habitat carrying capacity. In the Mississippi Delta’s productive environment, deer overpopulation can occur quickly, causing damage to the habitat and to agricultural crops planted for migratory waterfowl. Overpopulated deer herds can suffer from malnutrition, contract epidemic diseases, and increase the incidence of vehicle strikes. Public hunting programs are needed to consistently reduce the deer population by at least one third annually to keep pace with reproduction. A well-run, quality hunting program is needed to encourage hunters to continue to use Complex refuges.

Strategies:

- Conduct herd health checks every 3-5 years and monitor habitat conditions to determine the health and population of deer on the Complex.
- Operate check stations, as necessary, to collect the following data on harvested deer: age, sex, field-dressed weight, lactation, antler measurements and signs of hemorrhagic or other diseases.
- Evaluate deer populations annually, especially on Panther Swamp NWR following large flood events, and adjust hunting programs if needed.

Reptiles and Amphibians:

Discussion: Reptiles and amphibians are abundant on Complex lands, functionally important in freshwater and terrestrial habitats, and are key components of the ecosystem. In addition, many species of herpetofauna are wide-ranging and may serve as key indicator species for evaluating the environmental health of an ecosystem.

Strategies:

- Develop standardized data collection procedures for amphibians and reptiles.
- Conduct amphibian and reptile inventories to establish baseline information on species occurrence and habitat use.
- Use GIS technology to identify and map alligator nest locations.
- Use GIS technology to map amphibian breeding sites and identify species.
- On salamander (or other amphibians) breeding sites, conduct annual egg mass counts to determine use.
- Conduct calling frog surveys annually according to accepted protocols.
- Establish standardized reporting methods for important incidental sightings that include (at a minimum): species, date, specific location, and habitat type. Where possible, include size, sex, and age.

Fish:

Strategies:

- Survey refuge waters to identify fish species, age classes, and fish health.
- Use GIS technology to map fishery habitats on the Complex.
- Identify sources of contaminants from off-refuge lands, and work with Service contaminants specialist and Mississippi Department of Environmental Quality to conduct testing for pesticides and water quality.
- Conduct water quality testing on the spring at Morgan Brake NWR adjacent to North Hill Ponds to determine whether the spring's flow of groundwater is rich in calcium and magnesium bicarbonates, and should be properly classified as a fen. Fens typically contain rare plants and aquatic species that are rare in the Delta region.
- Conduct a baseline survey of fish and aquatic species in the spring at Morgan Brake NWR adjacent to North Hill Ponds.

Insects:

Discussion: The Complex has estimates of species for mammals and birds and a preliminary list of herpetiles, but for insects (95 percent of the biodiversity of the Complex) no information is available.

Strategies:

- Work with USDA and other researchers to survey insects on the Complex. Following collection, work with insect specialists to correctly classify species.
- Classify collected insects by Class, Subclass, and Family.
- Survey butterflies and moths for use in wildlife observation and photography for lepidopterans.

Invasives and Nuisance Species:

Strategies:

- Complete an inventory of all invasive and nuisance species on the Complex. Determine which species are causing, or may cause, ecological damage or other important problems and formulate plans to control or eradicate them.
- Continue monitoring cormorant populations and determine the impacts of cormorant populations on adjacent aquaculture ponds.
- Monitor cormorant nesting in Swan Lake and possibly White's Lane rookeries. Work with Wildlife Services and others to determine impacts on habitat and other rookery species.
- Collect baseline data on raccoon, beaver, nutria, coyote, armadillo, feral hogs, and other nuisance species and evaluate their effects on refuge resources.

Mussels:

Discussion: The Complex lies within the geographic range of 41 species of mussels. Of those, five are listed as either threatened or endangered. Historically, mussels were once abundant; however, dredging and channelization have altered habitat to such an extent that diversity has been greatly reduced. Only a fraction of the species have been found and identified, and many species may no longer exist on Complex lands. Remaining mussels and their habitats must be identified so that such information can be included in management decisions to prevent further losses.

Strategies:

- Survey refuge waters at 5-year intervals to identify species and distribution of mussels.
- Map collection sites or known locations of mussels and add data by species as encountered.
- Assemble a reference collection of mussel shells found on the Complex for aid in identification.

Bottomland Hardwoods:

Discussion: Complex lands contain some of the earliest known bottomland hardwood plantings in the LMRAV. Forest restoration enhances wildlife habitat, produces trees, reduces siltation, and captures carbon emissions. Given the proximity of the Complex to universities and interested federal agencies, opportunities exist to provide scientists with reforested research sites on Complex lands. Existing bottomland hardwoods that are artificially flooded during the winter season also provide opportunities for scientists to study habitat and species in GTRs.

Strategies:

- Promote research on Complex forestlands to identify management practices that can improve species diversity and habitat values.
- Build partnerships with universities to establish graduate programs that focus on the best methods for reforestation/afforestation and on hardwood forest management in the LMRAV.
- In GTRs, inventory and monitor tree vigor and diversity, including red oak regeneration.
- Monitor waterfowl use in GTRs.
- In GTRs, conduct GIS inventory and map full pool levels.
- In GTRs, maintain annual flooding records, drawdown dates, and water levels.

GOAL 4: DEVELOP LAND PROTECTION AND CONSERVATION PARTNERSHIPS

Discussion: Opportunities to work in partnership with private landowners, federal and state agencies, and non-governmental organizations are increasingly available. Linking habitat restoration and management projects can increase landscape level management for lands both inside and outside Complex boundaries. Although a large percentage of lands inside current acquisition boundaries have been acquired, some critical in-holdings are needed to meet habitat objectives, provide access to visitors, reduce off-refuge impacts, and protect unique habitats. Complex lands and surrounding areas have been identified for interior forest objectives by the LMVJV in support of the Partners-in-Flight Plan for the LMRAV.

Objective 4A: Support fish, wildlife, and cultural resources protection and restoration in the Yazoo Backwater Area and the Lower Mississippi River Alluvial Valley by acquiring the remaining 34,682 acres of land, from willing sellers, within the current acquisition boundaries, with special emphasis on those areas that would: (1) contribute to national and regional objectives, (2) provide additional wildlife-dependent recreational opportunities, (3) improve access, and/or (4) reduce impacts to refuge resources.

Strategies:

- Develop an outreach program that provides information on land acquisition and easement programs to landowners within the boundary expansion areas.
- Develop partnerships with conservation organizations, such as The Nature Conservancy, Trust For Public Land, and The Conservation Fund, to support land acquisition needs.

Objective 4B: Emphasize partnership efforts (e.g., Partners for Fish and Wildlife and carbon sequestration) in future boundary expansion proposals and easement programs in a "Conservation Partners" Focus Area.

A long-range goal of the Service is to establish a forested corridor to connect several refuges within the Complex. Such a corridor would be beneficial to migratory birds and the Louisiana black bear and promote bottomland hardwood reforestation. Morgan Brake NWR, Hillside NWR, Panther Swamp NWR, and the Carter Unit are located from north to south through Holmes, Humphreys, and Yazoo Counties with no connectivity. This Focus Area consists predominantly of cleared agricultural lands interspersed with remnants of bottomland hardwood forests, seasonally flooded and permanent wetlands, and cypress swamps. The primary influence is hydrology. In addition, intermittent backwater flooding from the Mississippi and Yazoo Rivers drives habitat processes. Due to low elevations and hydrological influences, most of the agricultural land is considered marginal for crop

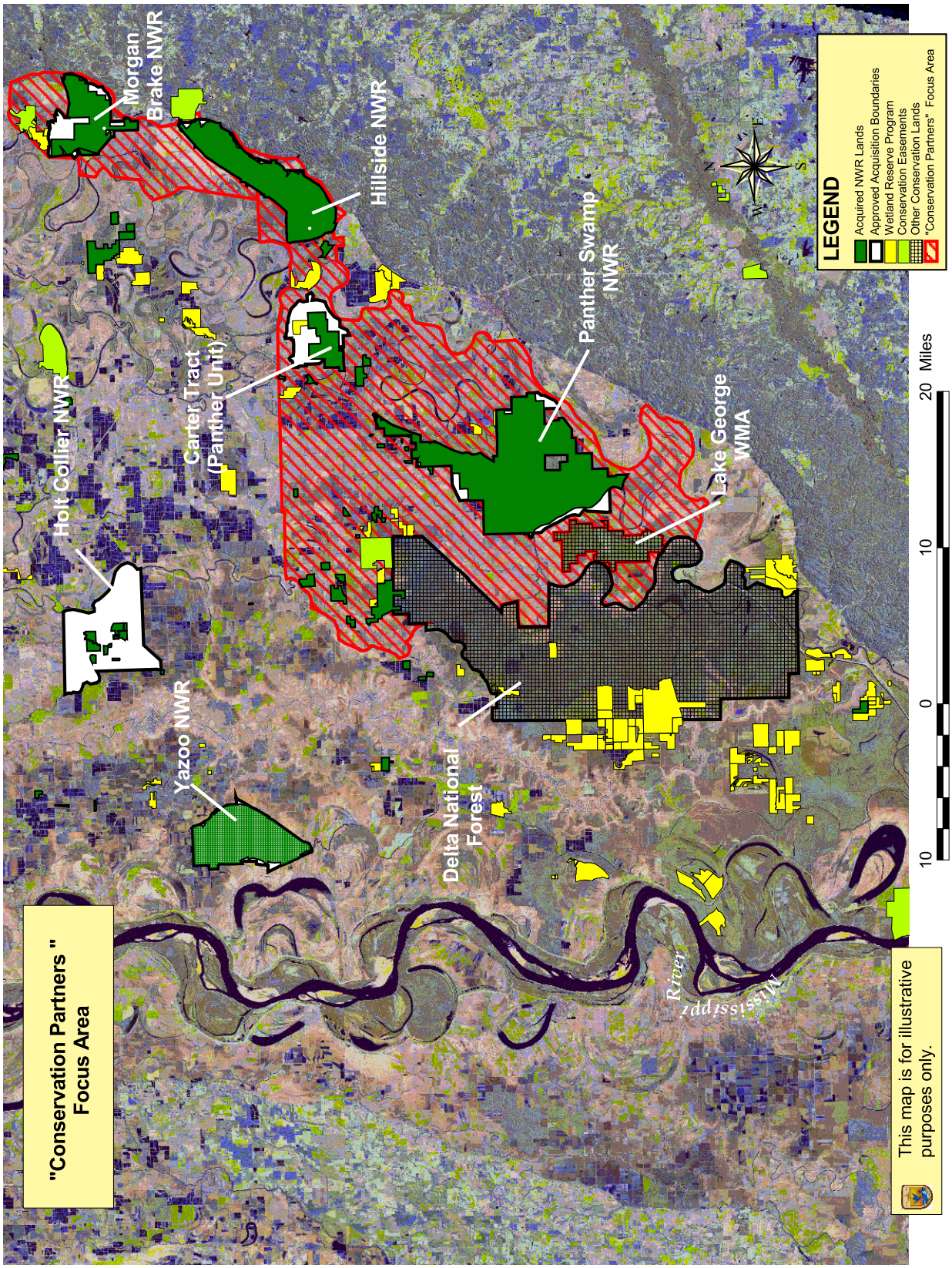
production. The Focus Area also includes steep loess bluff habitat bordering the east side of Hillside and Morgan Brake NWRs. A rapid transition from 70 feet MSL to 300 feet MSL produces abrupt changes in habitat, supporting unique plant and animal species, particularly for nesting and migrating songbirds. However, continued clearing for tree harvest and development off-refuge dramatically increases erosion and sedimentation on downstream refuge lands and waters. To focus available resources, the objective for this "Conservation Partners" Focus Area (Figure 16) will be to work with partners (state, federal, and non-governmental organizations and private landowners) to:

- Help achieve the objectives of national and regional plans;
- Restore migratory paths for wildlife;
- Create habitat for wintering and breeding waterfowl;
- Reduce off-refuge impacts to refuge resources;
- Provide better public access to refuge lands;
- Restore critical interior forest habitat for trust species, including the threatened cerulean warbler, swallow-tailed kite, and Louisiana black bear; and
- Restore the hydrology of the Yazoo Backwater Area.

Strategies:

- Compile a mailing list of potential state, federal, and conservation organization partners, and offer opportunities for these partners to assist the Complex to implement the CCP.
- Develop partnerships with Mississippi Department of Wildlife, Fisheries and Parks and interested non-governmental organizations to assist in upland game bird management.
- Evaluate opportunities to link conservation efforts with private landowners.
- Develop a "Conservation Partners" outreach program to educate and involve private landowners, conservation organizations, and federal and state partners in partnership efforts.
- Coordinate efforts with the LMJV Office in Vicksburg, Mississippi, and the Wildlife and Habitat Management Office in Jackson, Mississippi, to keep those offices updated on acres restored by habitat type, while ensuring partnership projects address the highest priorities within the LMRAV.

Figure 16. Conservation Partners Focus Area.



Objective 4C: Provide technical and financial assistance through the Partners for Fish and Wildlife Program for projects on at least 2,000 acres of private lands within the 9-county private lands program focus area. Focus on cropland enhancements for wintering waterfowl and reforestation objectives of national and regional plans for the LMRAV.

Private lands are important components to the restoration and reestablishment of native habitats.

Although the historically diverse fish and wildlife resources of pre-settlement America cannot be restored entirely, habitat restoration on private lands is important to the process. Objectives in national and regional plans, such as the North American Waterfowl Management Plan, Partners-in-Flight Plan, Mississippi River Alluvial Valley Bird Conservation Plan, and Strategic Fisheries Plan, will be emphasized.

The Service has two programs that provide technical assistance and funding for priority habitat projects on private lands. The Mississippi Partners Program (MPP) is an important cooperative program that provides pipe to develop winter water on harvested croplands for waterfowl. Partners include Mississippi Department of Wildlife Fisheries and Parks, Delta Wildlife, Ducks Unlimited, and Wildlife Mississippi. MPPs are considered enhancement projects and require a 10 to 15-year agreement. By 2004, MPP had developed agreements with over 968 landowners and provided over 3,554 water control structures designed to impound over 110,544 acres of winter water. The Partners for Fish and Wildlife Program (PFW) provides financial and technical assistance to private landowners who are interested in developing habitat on their lands. The PFW requires a minimum 10-year agreement.

Strategies:

- Work with the LMVJV and the Lower Mississippi Ecosystem Team to develop a 5-year Strategic Plan for habitat improvement projects on private lands.
- Establish an Annual Work Plan to address priority private lands issues that were identified under the 5-year plan and other appropriate sources.
- Expand the PFW program to more effectively involve key partners such as the Mississippi Department of Wildlife Fisheries and Parks, and other state, private, and national conservation organizations, in project development and implementation.
- Use Service project funds in coordination with private landowners and other partners to stretch habitat restoration dollars.
- Develop and implement follow-up studies on selected habitat improvements and technical practices, and distribute information to habitat restoration biologists.
- Integrate Service private lands programs and initiatives with USDA Farm Bill conservation programs. Coordinate appropriate Service projects on private lands with NRCS District Conservationist to maximize technical assistance and access to all appropriate conservation programs and opportunities.
- Ensure that the Complex PFW biologist is fully utilized in developing and carrying out authorized activities under approved Service strategic plans and activities defined under the PFW and other private lands initiatives.
- Partner with NRCS to provide landowners with information on the benefits of “conservation farming” and “best management practices” to reduce contaminant introduction through siltation, while enriching soil and improving water quality.
- Give highest priority to those projects located in the “Conservation Partners” Focus Area (Figure 16).

- Employ one GS-7/9 private lands biologist to assist the existing GS-11 PFW biologist to expand assistance, increase restoration, and conduct monitoring.

Objective 4D: Over the life of the CCP, address contaminants issues in refuge fish and wildlife and aquatic habitat by reducing siltation in the watershed.

Discussion: Because most of the lands in the watershed have been cleared and converted to agricultural row crop production, erosion introduces agricultural chemicals into runoff. Over the years, agricultural chemicals have bio-accumulated to unacceptable levels in fish and other wildlife species.

Strategies:

- Implement best management practices (e.g., drop inlet structures, reforestation, vegetative field borders) on Complex agricultural lands.
- Work with adjacent landowners in the watershed to improve water quality. Enroll riparian areas in conservation programs and cooperate with NRCS to provide technical assistance on "best management practices" to landowners.
- Develop and implement a contaminants monitoring plan to identify contaminant concentrations in refuge water, sediment, and fish and wildlife species.

Objective 4E: Over the life of the CCP, address fecal coliform bacteria issues in Black and Fannegusha Creeks on Hillside NWR.

Discussion: Water quality data collected by the Mississippi Department of Environmental Quality indicate high concentrations of fecal coliform bacteria in Black and Fannegusha Creeks. Because fecal coliform bacteria are present in these areas, there is a high likelihood that other forms of bacteria such as Salmonella, are also present. Therefore, as Black and Fannegusha Creeks overflow into wetlands on refuge lands, disease-causing bacteria could affect resident waterfowl populations.

Strategy:

- Coordinate closely with the Mississippi Department of Environmental Quality to ensure that sources of fecal bacteria are identified and eliminated.

Objective 4F: Over the life of the CCP, address increased sedimentation in refuge waterways resulting from upstream gravel mining and timber harvest operations.

Discussion: The Black, Fannegusha, Tesheva, and Abiaca Creeks introduce large sediment loads on refuge lands and produce a build-up of silt in bottomland hardwoods. Most of the sedimentation is due to upstream gravel mining operations, farming practices that do not address erosion, and timber harvests on adjacent lands.

Strategies:

- Coordinate closely with the Ecological Services Office in Jackson, Mississippi, to ensure that measures are included in gravel mining permits to substantially reduce sedimentation.
- Involve PFW biologist with adjacent landowners to provide technical assistance on timber harvest "best management practices."
- Identify lands in close proximity to refuges that contribute to the contamination and siltation on refuge lands and incorporate these areas into any future land acquisition boundary expansions.
- Develop an outreach program in cooperation with NRCS that can be used to educate surrounding landowners on the techniques for and benefits of reducing soil erosion.

Objective 4G: Manage Farm Service Agency properties by habitat type as they relate to the objectives established in this plan, and evaluate opportunities for wildlife-dependent recreation and demonstration sites.

Discussion: Many of the fee title Farm Service Agency properties managed by the Complex have been reforested, leaving few management options. Some are small in size, less than 100 acres, and disjunct from other protected lands. Management and protection of these areas are challenging because the lands managed in the Complex encompass acres widely scattered across central Mississippi. The most beneficial properties are those that have contributed to boundary expansions or are large enough to serve as a nucleus for additional units (e.g., Carter and Darlove tracts) and research (Brown Tract). (Farm Service Agency lands include the five tracts that were re-designated as the Holt Collier Refuge in the 2004 Consolidated Appropriations Act and are managed by the Complex.)

Strategies:

- Monitor reforested areas and evaluate suitability of replanting areas that have poor survival rates.
- Maintain unforested properties, <200 acres, in grassland and scrub/shrub habitat for migratory birds.
- Provide hunting opportunities for deer, small game, and upland game birds on properties, >300 acres, as populations reach harvestable levels.
- Assign law enforcement and habitat management responsibilities for each Farm Service Agency property to the refuge headquarters or specific subheadquarters.
- Evaluate properties to determine if any areas are suitable as demonstration sites for landowners who want to restore their properties for wildlife.
- Identify properties that may be suitable for wildlife observation and photography, including refuge-led birding tours, and for establishing photo blinds.
- Exchange Farm Service Agency properties, where possible, to help achieve refuge missions, goals, and objectives.

Objective 4H: Threatened and Endangered Species: Support recovery efforts for the Louisiana black bear.

Discussion: The Louisiana black bear is a threatened species that historically occurred throughout the south half of Mississippi and was reportedly common in the LMRAV. Habitat loss resulting from habitat conversions to agricultural fields and black bear exploitation throughout its range has seriously reduced populations. Recovery team efforts to introduce Louisiana Black bear in optimal

habitat are ongoing. Since Panther Swamp NWR contains one of the largest contiguous blocks of bottomland hardwoods in the State of Mississippi, and forest habitat is optimal for black bear, plans are to relocate individuals to Panther Swamp NWR in 2006 (personal conversation with representative of Mississippi Black Bear Restoration Task Force, December 2003).

Strategies:

- Enhance, restore, protect, and manage imperiled species habitat using available conservation tools including habitat management on existing land (federal, state and private) conservation easements, partnership agreements, conservation agreements, and land acquisition from willing sellers.
- Work with recovery team and Service Ecological Services Field Offices to establish Louisiana black bear populations in Panther Swamp NWR.

GOAL 5: CULTURAL RESOURCES – identify and protect cultural resources on the complex

Discussion: Cultural resources include archaeological resources, historic and architectural properties, and areas or sites of traditional or religious significance to Native Americans. (614 FW 1, Policy, Responsibilities, and Definitions.) Cultural resource inventories have been completed on 25,000 acres throughout the Complex, including comprehensive surveys on Yazoo NWR in 1978 and 1979 and selected surveys related to acquisition and construction on refuges in the Complex. The cultural resource inventories to date revealed that only Yazoo NWR has archaeology sites of significant cultural value. Five of the identified sites at Yazoo NWR are eligible for the National Register of Historic Places (NRHP), including the Swan Lake Indian Mounds, Deer Lake Village and Deer Lake Village South, the Steele Bayou site, and the Big Lake site.

Objective 5A: Identify and protect cultural resources on the Complex in accordance with federal and state historic preservation laws and regulations.

Discussion: Indian Mounds are the most obvious and well-known cultural resources in the Mississippi Delta region. As required by the Archaeological Resources Protection Act of 1979 and other laws, land management agencies must identify, research, protect, and provide cultural interpretation for the public. The Swan Lake Temple Mound near the bridge over Swan Lake on Yazoo Refuge Road is a source of great curiosity by the visiting public, and the refuge's proximity to the Winterville Mounds and Museum in Greenville, Mississippi, increase the likelihood that visitors already in the area will come by the refuge. Only minimal infrastructure would be required to prepare the Temple Mound for public use interpretation.

Strategies:

- Develop the infrastructure to provide interpretive information on Swan Lake Temple Mound Complex.
- Develop a scope of work for a comprehensive archaeological survey of any unsurveyed acreage, including a cost estimate and ranking factors for contractor selection.
- Develop and implement a plan to protect identified sites in consultation with federally recognized Native American tribes, the Mississippi State Historic Preservation Officer, and the professional archaeological community.

- Compile a comprehensive literature review of past archaeological, anthropological, and historical investigations within and near the Complex. Utilizing the Regional Archaeologist, produce an annotated bibliography to document the region's history and the utility of the scientific methodology.
- Develop a GIS layer for the archaeological and historic sites of the Complex that will mesh with existing layers for habitat type, vegetative cover, hydrology, and soils.
- Report new cultural resources sites to the Regional Historic Preservation Officer.

Objective 5B: Protect those cultural resource sites eligible for National Register listing from potential impacts by visitors.

Strategies:

- Develop and implement law enforcement procedures to protect these resources from looting and vandalism, and require all Complex law enforcement officers to take the "Archaeological Resources Protection Act" training course.
- Refer all requests for research, investigation, excavation, or removal of cultural resources to the Regional Historic Preservation Officer.
- Issue Special Use Permits, as appropriate, with the advice of the Regional Historic Preservation Officer to recipients of approved permits for cultural resource studies and research.
- Regulate visitor use on sensitive cultural resources, such as the Indian mounds on Yazoo NWR.

GOAL 6: PROVIDE VISITOR SERVICES – develop appropriate and compatible wildlife-dependent recreation, environmental education, and interpretive programs that lead to enjoyable experiences and a greater understanding of fish, wildlife, and habitat conservation by the public.

Discussion: National wildlife refuges provide a variety of recreational opportunities for the visiting public. The 1997 National Wildlife Refuge System Improvement Act identified six priority public uses on refuge lands, including hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation. With the appropriate infrastructure, Complex lands can provide opportunities for all of these priority public uses. Historically, hunting has been the primary public use activity on Complex lands. A primary goal for the Complex is to increase public understanding, use, and enjoyment of Complex lands, and to increase an appreciation for the Refuge System through a transition toward developing more infrastructure and providing personnel to support the five remaining priority public uses. A public use plan will include options for minimizing potential conflicts between hunting and fishing, and non-consumptive uses.

Objective 6A. Provide public hunting for deer, ducks, small game, and wild turkey.

Discussion: Managing wildlife populations and their habitats is the primary responsibility of the Complex and a required component of the Refuge System's "wildlife first" mission. If managed appropriately, hunting provides a biologically sound form of outdoor recreation that is used extensively throughout the Refuge System to manage wildlife populations. The 1997 Improvement Act, other laws, and Fish and Wildlife Service policy permits hunting on refuges when it is compatible with the purposes for which the refuge was established. The Complex hunting program is coordinated annually with the Mississippi Department of Wildlife, Fisheries and Parks and hunting activities are managed so as not to cause disturbance to waterfowl.

White-tailed deer hunting is a popular activity throughout the region and the Complex has a reputation for outstanding deer hunting opportunities. Harvest and habitat data collected over the years have clearly demonstrated the need to remove approximately one third of the deer annually in order to maintain a healthy herd and to prevent habitat damage. In the absence of large predators, such as wolves or cougars, deer populations can rapidly increase and destroy valuable wildlife habitat. Deer eat the understory in forested areas, preventing tree regeneration and altering the structure and species (flora and fauna) composition of the forest. Deer also consume agricultural crops planted as high calorie foods for wintering waterfowl.

Because four of the refuges in the Complex were established for migratory birds, deer populations must be controlled to prevent adverse impacts to migratory bird habitat. Deer possess the ability to overpopulate and exceed the carrying capacity of refuge habitats in a relatively short time frame. Overcrowded deer herds degrade their own habitat, as well as habitat needed by numerous other wildlife species when they consume vegetation. Over-browsed habitat cannot provide food or cover for scrub- shrub-dependent species. Deer can also eliminate habitat for other birds when they consume the vegetation that the birds use for cover or nesting habitat.

Yazoo NWR produces approximately 200 deer each year that are surplus to population maintenance (Yazoo NWR data files). Deer herds can radically reduce food resources to such an extent that they starve or contract diseases that under normal circumstances they would not contract. The lack of sufficient food on refuge lands would force deer to move beyond refuge boundaries onto adjacent private land where they consume agricultural crops planted by refuge neighbors. Allowing hunters to remove surplus deer reduces the potential for refuge habitat damage and agricultural crop losses, and negates the expense of controlling the deer herd with refuge employees.

The Complex's deer population management program is dependent upon the ability to attract sufficient refuge hunters each year to reduce the deer population to below carrying capacity. During normal reproductive years, the refuge's objective would be to remove approximately 33 percent of the deer population. Refuges are challenged to attract a sufficient number of hunters to reduce the population to the targeted level. Typical deer do not provide an incentive to the hunting public because hunters can take typical deer at alternate hunting areas throughout the Delta. To pique the hunter’s interest and draw them to refuges for deer hunting, an element must be added that is not available to the average hunter elsewhere in the Delta. Historically, this has been accomplished by providing the expectation that a trophy buck can be harvested from refuge lands.

The Complex's hunt program is designed to optimize the number of deer taken while maintaining a percentage of older bucks (5 to 10 percent) in the trophy class each year to attract enough hunters to reduce the herd by 33 percent. To date, Complex efforts have attracted sufficient hunters to remove the desired number of deer. Although total numbers of out-of-state hunters were not recorded, refuge personnel noted the presence of hunter vehicles from 26 states during the 2003 hunt year.

To ensure that migratory bird habitat (the purpose for which four of the refuges were established) is not adversely affected by deer populations, annual public deer hunting opportunities will be offered. The program will aim for removal of approximately one-third of the herd annually with a 1:1 harvest ratio of the sexes. The regulation of season lengths, hunting areas, and hunter quotas will ensure a balance between population levels and carrying capacity, while providing for public safety during hunting season.

Hunting is also offered for populations of animals capable of sustaining harvest, including ducks, rabbit, squirrel, raccoon, opossum, and quail. Hunting programs for these species are not aimed at controlling the numbers of animals to reduce habitat destruction, with one exception. Raccoons prey upon wood ducks and their eggs, and those of other nesting birds, and occasionally eggs from alligator nests. Hunting programs for ducks and other small game are very popular and contribute to the Complex's public use program.

Strategies: Strategies are dependent upon the availability of funding and adequate law enforcement staff to manage the hunts.

- Maintain a stable deer population through a program of either-sex hunting.
- Coordinate with Mississippi Department of Wildlife, Fisheries and Parks, interested conservation organizations, and natural resource agencies when developing hunt programs.
- Construct a self-service visitor resources kiosk at the Complex Headquarters at Yazoo NWR and refuge offices at Morgan Brake and Panther Swamp NWRs to provide maps, regulations, hunting brochures, permit applications, fact sheets, and other visitor services information.
- Develop a hunting program section in the step-down Visitor Services Plan.
- Provide limited draw youth hunts for white-tailed deer on Morgan Brake NWR.
- Provide youth waterfowl hunts on Yazoo NWR and the Carter Tract and limited-draw youth turkey hunts on Hillside, Morgan Brake, and Yazoo NWRs.
- Provide additional hunting opportunities for bobwhite (when it is determined that birds are at harvestable levels) on the following Farm Service Agency properties: Herron, Brown, and Carter Tracts. Open season dates will coincide with the dates for the rabbit (with dogs) hunt.
- Provide limited-draw turkey hunting opportunities on Hillside, Morgan Brake, and Yazoo NWRs as bird populations reach harvestable levels.
- Develop limited-draw waterfowl hunts at Mathews Brake NWR to address overcrowding and safety issues.
- Promote and encourage hunting opportunities on the Complex through the Internet site, brochures, kiosks, news releases, displays, and special events.
- Explore and develop handicapped-accessible hunting opportunities for deer and turkey.
- Provide opportunities for senior citizens to hunt deer and turkey.

Objective 6B: Provide hunters with a high quality, safe hunting experience on refuge lands, while balancing consumptive and non-consumptive public uses.

Discussion: The congregation of game species in a small geographic area leads to concentrations of hunters in the same area. The cultural pressure associated with taking a trophy buck or a limit of ducks produces intense law enforcement (LE) challenges that are not encountered during non-consumptive public use activities, such as bird watching, nature trail hikes, or wildlife photography.

Many hunts require a minimum of two, and at times, more LE officers to meet resource and public protection needs. Limited draw permit hunts require more LE attention than unlimited hunts, and deer hunts require the most attention. In 2003, LE Officers issued 143 Notices of Violations, while an estimated 5000+ incidents (e.g., vehicle break-ins, stolen property, vandalism, firearm violations, disorderly conduct, driving under the influence, poaching, and trespass) were noted.

One option for coping with staff shortages is to reduce hunting programs to a level that available LE staff can cover. Proposed consolidations/restructuring for deer hunts yield the greatest potential for conserving LE staff, while continuing with other hunting programs, because deer hunting produces the greatest need for LE presence. Contentious interactions between hunters and LE officers, issues involving weapons and public safety, public hunting pressure expressed by numbers of hunters (thousands), and the need to provide LE coverage on all refuges during all peak deer hunting seasons are important factors.

Strategies for an LE Staff of 11: 4 full-time law enforcement officers and 7 dual function officers:

- Provide safe, year-round public protection for visitors to refuge lands.
- Schedule law enforcement officers on a year-round basis to cover expanded public use activities and to ensure a balance between non-consumptive public use activities, hunting, and fishing programs.
- Continue existing 6-month long hunting seasons for 15 separate hunting programs.
- Expand white-tailed deer hunting opportunities for youth by providing limited draw youth hunts on Morgan Brake NWR.
- Expand waterfowl hunting opportunities for youth by providing waterfowl hunts on Yazoo NWR and the Carter Tract, and limited-draw youth turkey hunts on Hillside, Morgan Brake and Yazoo NWRs.
- Expand hunting opportunities for bobwhite (when it is determined that birds are at harvestable levels) on the following Farm Service Agency properties: Herron, Brown, and Carter tracts.
- Expand turkey hunting opportunities by providing limited-draw turkey hunting on Hillside, Morgan Brake, and Yazoo NWRs as bird populations reach harvestable levels.
- Expand waterfowl hunting opportunities by developing limited-draw waterfowl hunts at Mathews Brake NWR.
- Employ an aggressive promotional program to encourage hunting on the Complex through the Internet site, brochures, kiosks, news releases, displays, and special events.
- Expand opportunities for handicapped hunters to take deer or turkey.

Strategies for an LE Staff of five:

- Notify the public that changes are proposed in the Complex's hunting programs. Notify the public by contacting Mississippi's federal and state agencies and elected officials; distribute news releases and public service announcements; publish new Hunt Brochures; post notices on the Complex Website, kiosks, and hunter check stations. Proposed reductions would be as follows:

*All current unlimited permit hunts would remain the same, EXCEPT:

- The Panther Swamp NWR muzzleloader deer hunt would be changed to a limited permit draw hunt and reduced from 15 to 5 days (December 4 through December 8).
- The Morgan Brake and Hillside NWR's muzzleloader deer hunts would be changed to limited permit draw hunts and reduced from 13 to 5 days (November 28 through December 1).
- Limited permit draw hunts on Morgan Brake, Hillside, and Panther Swamp NWRs would be scheduled to ensure that only one limited permit hunt would be held on any of these refuges at any given time (no overlapping days on one or more refuges).
- Mathews Brake NWR would be closed to hunting and all other forms of public use from November 20 to December 20 to prevent compromising public safety.

- Morgan Brake, Mathews Brake, and Hillside NWRs would remain closed to all public use during the Panther Swamp NWR limited permit draw gun deer hunts (November 20-22, and December 16 -20); and the limited permit draw muzzleloader deer hunts December 4-8.

Strategies for an LE staff of four or less:

- Limited permit draw 2-day gun deer hunts on Yazoo (150 youth permits each day); Hillside (250 permits each day); Morgan Brake (50 permits each day); and Panther Swamp NWR (800 permits each day).
- Close all refuges to non-consumptive public use activities (except Yazoo NWR) during limited permit hunt days.
- No unlimited permit deer gun hunting.
- Unlimited permit archery hunts for deer and small game.
- Farm Service Agency tracts open to archery hunts for small game and deer.

*Note: Any additional unforeseen reductions in law enforcement capability would require further reductions in hunting programs.

Objective 6C: Within 5 years of CCP approval, provide accessibility to disabled hunters by constructing accessible, dedicated hunting areas and offering sponsored hunts.

Strategies:

- Partner with local groups to sponsor a 2-day disabled annual waterfowl hunt on Morgan Brake, Hillside, Yazoo, and Mathews Brake NWRs. Rotate hunters to different refuges annually to provide a diversity of experiences.
- Provide disabled hunting blinds on Morgan Brake and Hillside NWRs where persons with physical impairments can use all-terrain vehicles to hunt deer.
- Provide opportunities for disabled individuals to hunt turkey on Yazoo, Panther, Hillside and Morgan Brake NWRs.

Objective 6D: Annually provide high quality fishing opportunities consistent with sound biological principles while meeting the Complex purposes and objectives for migratory birds.

Discussion: Contaminants (DDT and toxaphene) in fish accompanied by accelerated siltation have reduced the quality of the fishery on Yazoo NWR, introduced chemical contamination in resident fish, and effectively eliminated fishing as a public use activity. Fishing is available on Morgan Brake, Panther Swamp, and Mathews Brake NWRs, but generally lacking on Hillside NWR due to shallow waters. Opportunities to offer quality fishing should be pursued, and areas open for fishing should be located so as to minimize disturbance to migratory birds.

Strategies:

- Develop a public fishing management section in the Visitor Services Plan in consultation with state management agencies, federal partners, conservation organizations, and the public.
- Consult with the Service's Baton Rouge, Louisiana, Fishery Resources Office to obtain assistance for inventory and evaluation, and habitat improvement recommendations for the Complex's fishery resources.

- Develop a youth fishing area at Holt Collier Horseshoe Pond (Yazoo NWR) to provide educational and recreational opportunities to youth. This pond is hydrologically separate from Steele Bayou, the primary source of DDT and toxaphene contaminants on the refuge, and can potentially provide contaminant-free fishing opportunities.
- Periodically monitor fish populations at Holt Collier Horseshoe Pond to ensure that contaminant levels are not prohibitive.
- Develop abandoned bridge at Stricklands Crossing (Panther Swamp NWR) for use as a universally accessible fishing pier.
- Develop at least three walk-in bank fishing sites on Caldwell Road (Mathews Brake NWR), and mark and maintain an access trail.
- Develop individual fishing brochures for refuges offering fishing opportunities.
- Promote and publicize public fishing via the web, brochures, news releases, displays, and special events.
- Conduct annual fishery/creel surveys to assess success and to provide a visible presence that will support law enforcement efforts to reduce unauthorized fishing, littering, and other unlawful incidents.

Objective 6D: Provide hunters with adequate ingress and egress to ensure a sufficient deer harvest by maintaining suitable ATV trails, establishing walking/retrieval trails, and constructing boat ramps at suitable locations.

Discussion: The dispersal of hunters over a large area reduces problems associated with hunter overcrowding, and improves the deer harvest rate. Currently dispersal is accomplished by a limited number of roads and ATV trails. ATV trails are available on Panther Swamp, Hillside, and Morgan Brake NWRs in accordance with established mandates and Service policy (see Issues and Concerns; Chapter III). The ATV trails are well defined on hunt brochure maps and are open only during periods of hunting and fishing. However, on Panther Swamp NWR, the local “gumbo” soils do not support trails or roads. Most trails are currently degraded to the point that even foot traffic is difficult. Degraded ATV trails are nearly impossible to navigate by ATV, so operators cause additional habitat damage when they divert from the established (although degraded) trail and drive the ATV through the forest.

Costs for improving ATV trails to a satisfactory condition are estimated by Fish and Wildlife Service’s Engineering Division in Atlanta, Georgia, at approximately $50,000 per mile. At that price, the cost of improving Panther Swamp NWR’s approximately 38 miles of trails would be approximately $3.4 million (Table 15). This is more than the entire refuge Complex budget and the Service cannot responsibly cover such high maintenance costs solely to provide hunter access. Even with a substantial amount of expensive maintenance, some trails on Panther Swamp will never support sustained traffic.

To reduce maintenance costs and minimize habitat damage on Panther Swamp NWR, 19.78 miles of existing ATV trails will be closed or converted to walking/retrieval trails. Walking/retrieval trails can be used as ATV trails only to pick up and retrieve deer or to carry decoys and other equipment to duck hunting areas during hunting season. Approximately 3.5 miles of interior roads will be opened to ATV use during hunting season. ATV access will be improved in 9.6 miles of established powerline (Entergy) and pipeline (Southern Natural Gas) rights-of-way, and on trails that can be improved and maintained in satisfactory condition without significant expense. The powerline and pipeline rights-of-way have been selected to provide ATV access because they are currently established, permanent corridors through the forest that have already been cleared and are regularly maintained to eliminate the establishment of woody vegetation. Trails branching off the rights-of-way will be converted to walking/retrieval trails, where practicable. If access is acquired on the east side of the refuge off River Road, the ATV trails that provide access south of the gas pipeline right-of-way will be converted to walking/retrieval trails.

Some ATV trails that provide access to duck hunting areas will be improved to ensure that duck hunters can carry their equipment (e.g., decoys and blinds) to hunting sites. To compensate for trail closures and for ATV trail conversions to walking/retrieval trails, access by water will be improved. Two 20-foot-wide concrete boat ramps will be constructed at Wade Bayou off the east levee and at Lake George off the west levee south of Bobcat Trail.

Table 15. Estimated Costs to upgrade ATV Trails to "Satisfactory" Condition

Refuge	Miles of ATV Trails	Cost Per Mile to Improve	Total Cost to Upgrade
Panther Swamp NWR	38	$90 - 120,000	$3,420,000+
Hillside NWR	9	$20,000	$180,000
Morgan Brake NWR	8*	$15,000	$120,000
Yazoo NWR	0	--	--
Mathews Brake	0	--	--

Source: U.S. Fish and Wildlife Service, Engineering Division, Atlanta, Georgia
*Morgan Brake NWR allows ATV users to use certain refuge roads during hunting season. None of the roads are defined as ATV trails.

Strategies:

- Reduce ATV trail maintenance on all refuges in the Complex by closing high maintenance trails and converting the remaining trails to retrieval/walking trails.
- Obtain funding to rehabilitate selected trails on Panther Swamp, Hillside, and Morgan Brake NWRs.
- Update ATV trail use specifications and use plans for Panther Swamp, Morgan Brake, and Hillside NWRs. These plans will: Define "ATV" based upon manufacturer's recommended number of passengers, engine size, vehicle weight, length and width, and tire size. Identify ATV trails that are open for public use. Specify minimum trail standards, including width and required surface material. Include measures to reduce impacts to wetlands, aquatic habitats, and streams. Identify precautions to protect habitat and minimize disturbance to wildlife. Limit ATV use on retrieval trails to retrieving deer killed during refuge hunts.
- After selected ATV trails have been restored, establish an ATV use permit fee to cover trail maintenance and program management. Monies obtained from this fee will be specifically used for maintenance of existing ATV trails.
- Provide funding to develop or improve parking areas at all trail heads.

- Establish a total of 14 trail heads on Panther Swamp, Hillside, and Morgan Brake NWRs with kiosks containing information on regulations, safety, maps, and areas of interest.
- Convert 3 trails on Panther Swamp NWR (that currently provide access by boat from Lake George or are located in close proximity to another ATV trail) to walking trails.
- Shorten existing ATV trails where appropriate and convert the restricted sections to walking trails.
- Eliminate unneeded trails as land is acquired on the east side of the refuge and access improves.

Objective 6E. Provide an environmental education program, on- and off-refuge, to no less than 2,000 students (preschool to high school) and 500 adults annually. Aim for a 2 percent annual growth in individuals educated.

Discussion: There are no established educational programs or facilities within the communities surrounding the Complex that provide students or adults with a better understanding of the environmental resources in the LMRAV. A quality environmental education program would lead to increased awareness and stewardship for the environment, strengthen the connection between wildlife and people, and foster understanding and support for refuge purposes, issues, and programs. The programs will be community-based and developed with support from Visitor Services' staff, area schools, and other area educational organizations.

Strategies:

- Recruit two full-time GS-7 Park Ranger (Interpretive) environmental education specialists. These positions will support the Complex Outdoor Recreation Planner and Outdoor Recreation Specialist.
- To ensure the materials are dynamic and meet the needs of adults and students in preschool through high school, the Complex's environmental education curriculum will be developed in coordination with Visitor Services staff and local educators. The programs will focus on refuge issues and will be reviewed every 4 years to ensure they are meeting the needs of groups and schools, while providing up-to-date information on refuge programs.
- Effectively promote the environmental education program through the Internet, public news releases, refuge kiosks, and visitation to local communities and schools.
- Use partnership agreements with local schools in order to clearly articulate program goals and objectives and to build strong educational partnerships.
- Ensure that the construction of any visitor services facilities provides a classroom setting, materials, and displays that can be incorporated into an on-refuge education program.
- Conduct at least one teacher workshop each year using established programs developed by the Service and the Visitor Services' staff (e.g., Project Wild or Project Learning Tree).
- Develop 5 - 10 subject-specific "canned" programs that refuge staff, teachers, or volunteers can present at the schools.
- Train volunteers to lead group education programs on the refuge and possibly take the programs to the schools.
- Develop environmental education sites and a teacher activity guide for Deer Lake, Alligator Pond Observation Platform, Holt Collier Boardwalk Trail and Tower (Yazoo NWR), and Alligator Slough Nature trails (Hillside NWR), including bus parking, activity sites, and shelter. Develop 50 individual activity backpacks that can be used for these programs.
- Link the Complex website with local chambers of commerce and other visitor service providers to inform and educate the public about the resources and wildlife-dependent recreational opportunities provided on the Complex.

Objective 6F: Provide the infrastructure for a minimum of 10,000 high quality wildlife interpretive visits per year to increase awareness of habitat features, wildlife values, and purposes, and management programs on the Complex and the National Wildlife Refuge System.

Discussion: Education and interpretation programs are important components to ensure public understanding and appreciation for the natural environment and the fish and wildlife that inhabit refuge lands. The implementation of this plan will lead to greater support for refuges at both local and national levels.

Strategies:

- Identify key resource issues and concerns to develop an effective interpretive program.
- Promote a wildlife-first scheme Complex-wide for all interpretive programs.
- At all major entrances, check stations, boat ramps, and parking areas, provide a kiosk that orients the visitor and provides information regarding the Complex and the National Wildlife Refuge System.
- At all observation sites (e.g., towers, platforms, and parking areas) provide appropriate interpretive panels describing ongoing management practices on refuges and their benefits to fish and wildlife.
- Develop fact sheets on key resource issues and distribute them at outreach programs, post them on kiosks, and add to the Complex's Internet site.
- Develop a visitor brochure for each refuge office or visitor contact station (Yazoo, Panther Swamp, and a combined Hillside, Mathews Brake, and Morgan Brake NWRs) to identify refuge purpose, resource values, the refuge's importance in the LMRAV, and wildlife-dependent recreational programs available at that refuge.
- Ensure that interpretive exhibits relative to the resources of the Complex and the LMRAV are placed in any future visitor services centers.
- Develop a Sign Plan that addresses orienting visitors while interpreting the natural resources of the Complex and the mission of the National Wildlife Refuge System.
- In cooperation with refuge volunteers and others, conduct no fewer than 50 quality interpretive programs annually. Keep interpretive programs relevant and up-to-date by continually updating, improving, and/or replacing individual programs.
- Develop new and improve existing foot-traffic-only interpretive nature trails, for the following refuges: Yazoo NWR: Yankee Run Trail near Alligator Pond, Bear Paw Trail near Lizard Lake, Carbon Sequestration Demonstration Trail on Yazoo Refuge Road. Morgan Brake: Loess Bluff Trail on southeast corner of Morgan Brake NWR. Hillside NWR: Alligator Slough Nature Trail near Alligator Slough. Panther Swamp NWR: Panther Run Trail on the north end of Lower Twist.
- If the land can be acquired from willing sellers, or an easement for access is obtained, develop a kiosk station on the bluff overlooking Morgan Brake NWR, providing an interpretation of refuge habitat and information on wildlife and fisheries management programs.
- Develop an orientation film that interprets refuge resources and the unique values of the LMRAV.
- Update or install three-panel informational kiosks at the Complex headquarters and at the Panther Swamp and Morgan Brake refuge offices.
- Promote and encourage wildlife interpretation opportunities on the Complex through the Internet site, brochures, news releases, displays, and special events.

Objective 6G: Provide additional opportunities and facilities for wildlife observation and photography on each of the refuges within the Complex.

Discussion: Although opportunities for wildlife observation, wildlife photography, and other related activities, such as hiking and birdwatching, are excellent, the infrastructure to develop these public use activities is limited. The Holt Collier Boardwalk and Observation Tower and Alligator Pond Observation Tower at Yazoo NWR were constructed in 2002, and were the first of the Complex's planned public use structures and features. Morgan Brake NWR's Trillium Bluff Trail is planned for 2006. As more facilities are constructed and outreach is extended to the public about their availability, non-consumptive public use activities on the Complex are expected to increase.

Strategies:

- Develop an accessible waterfowl observation and photography platform on the Pryor Impoundment on Yazoo NWR.
- Re-name the Cope Impoundment to Beargarden Lake and construct the Beargarden Lake Trail and Lookout Platform to observe and photograph the colonial waterbird rookery and other birds.
- Develop Theodore Roosevelt Auto Tour and Lost Pool Drive wildlife observation and interpretation drives on Yazoo NWR and Panther Creek Auto Tour at Panther Swamp NWR.
- Develop a walking trail on Morgan Brake NWR around the Providence Ponds to provide opportunities for viewing and photographing waterfowl, shorebirds, and wading birds.
- Develop a public viewing area with informational kiosk at Alligator Alley adjacent to Headquarters at Yazoo NWR, to enable visitors to view resident alligators, and learn about their reproductive and habitat requirements.
- Provide the public with no fewer than five (one for each refuge) portable photography blinds to be used at selected sites throughout the Complex.
- Work with local partners to sponsor an annual Complex photography or art contest.
- Complete Gator Walk, an observation and photography foot trail at Alligator Pond on Yazoo NWR, including parking areas and kiosks.
- Develop an observation platform on Mathews Brake NWR at the "old cold well camp site" south of the boat ramp.
- Develop a wildlife observation foot trail off the west levee on Panther Swamp NWR.
- Develop the Anhinga Swamp Canoe Trail at Yazoo NWR (in Swan Lake), and additional canoe trails at Mathews Brake and Panther Swamp NWR (Panther Creek).
- Develop an observation platform at Morgan Brake NWR overlooking the moist-soil impoundments (former catfish ponds).
- Develop an observation site off the west levee of Panther Swamp NWR overlooking the panorama of the refuge at the Lower Twist fields, providing interpretive panels of refuge resources and management programs.
- Upgrade the boardwalk areas along the Alligator Slough Nature Trail (Hillside NWR) to meet accessibility and safety standards.
- With refuge staff or volunteers, conduct no fewer than eight birdwatching/wildlife observation programs for the public each year. In addition, conduct no fewer than two similar tours for disabled visitors each year.
- Cooperate with the local garden clubs to offer a butterfly garden with host and nectar plants at the refuge headquarters and each refuge office. Display a collection of butterfly species at the visitor contact stations.

- Create a Complex website to extend information about wildlife observations and opportunities to the public. Link the Complex's Internet site to other important wildlife observation sites, including state conservation and natural resource agencies.
- Promote and encourage wildlife observation and photography on the Complex through brochures, news releases, displays, special events, and Internet.

Objective 6H: Provide a highly visible and dynamic volunteer and intern workforce and establish a Friends Group to assist and support all aspects of Complex operations, including environmental education, wildlife interpretation, habitat improvement, visitor facilities maintenance, and funding needs.

Discussion: Effective volunteer, intern, and Friends Group programs are key to the success of this plan. The benefits of these dedicated private citizens go far beyond their contributions to the workforce on the Complex. They can be the voice, eyes, and ears for their communities and they bring innovation and support to all refuge programs.

Strategies:

- Develop an outreach program and campaign to recruit volunteers to assist in executing refuge programs, including data collection and habitat management, interpreters and educators, and maintenance.
- As the volunteer program grows, establish a "Volunteer Council" group that will provide support and bring a variety of perspectives to the Complex on volunteer issues.
- Enhance communication with Complex volunteers and other members of the interested public through various forms, including periodic newsletters, the Complex's Internet website, and recognition events.
- Develop high-quality training for refuge volunteers so they are able to effectively and efficiently complete projects and responsibilities.
- Expand efforts to provide volunteer opportunities to members of the disabled public
- Develop agreements with universities, colleges, and technical schools to provide internship opportunities conducive to all programs conducted on the Complex.
- Work with local communities and refuge users to develop a "Friends Group," a grassroots nonprofit organization that can provide volunteer and financial support to the Complex and serve as an advocate for the Complex, the LMRAV, and the National Wildlife Refuge System.

Objective 6I: Develop new and maintain existing facilities to promote public advocacy and use. Ninety percent of visitors will report satisfaction with the safety, comfort, and functionality of these facilities and express a desire for a return visit.

Discussion: Public use facilities will be developed and maintained at a high standard, ensuring public safety and reflecting a positive impression on visitors. Included on this list of facilities are refuge trails, parking lots, and the future visitor contact center and stations. To the extent practical, all facilities will be made accessible to disabled visitors. Appendix VI includes examples of proposed facilities for Yazoo NWR.

Strategies:

- Construct a Visitor Center/Complex Headquarters facility on Yazoo NWR and Visitor Contact Stations/Office at the two refuge offices on Panther Swamp and Morgan Brake NWRs. The Visitor Center at Yazoo NWR will be located at the west end of Beargarden Road at the intersection of Yazoo Refuge Road. The refuge office on Panther Swamp NWR will be relocated to higher ground on main access roads when opportunities to acquire the land from willing sellers or donators become available. These relocations would make visitor contact areas more pleasant, visible, and accessible, and improve proximity to interpretive opportunities.
- All existing and new Complex visitor facilities will be reviewed to determine what measures need to be taken to make them more accessible to disabled persons. Following this review, an implementation plan will be developed and funding will be sought to upgrade these facilities.
- Obtain operational funding to employ a WG-6 maintenance worker to enhance the Complex's capability to maintain new and existing public use facilities.
- Seek sufficient increase in funds to maintain, to a high standard, new, and existing visitor service facilities such as signs, trails, kiosks, and visitor contact stations.
- Employ a GS-11 Outdoor Recreation Planner who will initiate early planning for the proposed Visitor Center at the Headquarters and Visitor Contact Stations at each refuge office. Following completion, this employee will assume responsibilities for operations of these and all other visitor facilities.
- Construct public restroom facilities at the headquarters office and refuge offices sufficient to provide for groups of ten or greater.
- Construct four additional parking lots, to include bus parking, in areas designated as Outdoor Classrooms.

GOAL 7: ADMINISTRATION – obtain and implement approprate management strategies to improve infrastructure and add support staff to meet the needs of an expanding visitor public, and to facilitate responsible biological, maintenance, and law enforcement programs.

Discussion: Refuges require adequate staff, facilities, equipment, and funding to accomplish their defined purposes, and the goals, objectives, and strategies identified in this CCP. Administrative functions include a wide variety of activities that are vital to the Refuge System mission including budget execution, personnel management, personnel training, habitat and public use planning and management, computerized databases, road infrastructure, law enforcement, facilities management and maintenance, community relations, and partnerships.

Objective 7A: Provide adequate and functional offices and maintenance facilities to support existing and future expansion of refuge programs and to ensure safe and efficient refuge operations.

Discussion: Office space at the Complex Headquarters and refuge office at Panther Swamp NWR are currently inadequate for present needs. A new refuge office was constructed at Morgan Brake NWR in 2004. An immediate need exists to construct a new facility at Yazoo NWR to function as a Headquarters Office for the Complex, and as an area to greet the public and provide for their wildlife-dependent recreation requests. The new facility would contain an educational visitor resources center with reception area, display room, public restrooms, employee restrooms, conference room, songbird viewing and feeding atrium, office space for refuge staff, and other resources to enhance

public use of the refuges within the Complex. An equally immediate need exists to construct a new refuge office for Panther Swamp NWR.

The current Headquarters Office was constructed in 1958 and is functionally outdated. It provides only one restroom for both male and female employees, and the sink in the bathroom provides the only running water in the office. The office is not disabled accessible, and individuals in wheelchairs would not have access to the one restroom due to a narrow doorway and cramped quarters inside the restroom. The heating system is a propane gas-based furnace that is outdated. The building lacks storage for basic office needs. Because the front door of the office is located on the side of the building facing away from the highway, and for other structural reasons, the office does not provide a favorable appearance to the visiting public.

Panther Swamp NWR's office consists of a deteriorated house and shop area, both in need of replacement. The office is subject to flooding 2 out of 10 years and the repeated flooding has deteriorated the building and foundation. Water damage producing slab upheaval, substandard wiring, an aged septic system, and heating and cooling systems reaching the end of their lifespans require expensive repairs.

Strategies:

- Construct a Complex Headquarters/Visitor Center on Yazoo NWR, at the intersection of Beargarden Road and Yazoo Refuge Road, with ample space to accommodate staff, storage, safety, and visitor needs.

- Construct a refuge office at Panther Swamp NWR either on Highway 49 or River Road (outside of the floodplain), and convert the current office "house" to refuge housing for volunteers and seasonal employees.

- Expand equipment storage facilities at Panther Swamp NWR.

Objective 7B: Provide adequate staff and sufficient resources to manage the refuges and Farm Service Agency tracts in Complex in accordance with the purpose for which each refuge was established and the mission of the Refuge System.

Discussion: The Complex lacks sufficient staff to achieve management goals and objectives. Critical staff needs include law enforcement; refuge managers; resource specialists such as foresters, biologists, biological technicians; interpretive staff; GIS Specialists; outdoor recreation planners; administrative support staff; and maintenance personnel. Currently there are 17 full-time employees to manage all seven refuges in the Complex. Refuge lands are scattered across central Mississippi, and encompass more than 90,000 acres. Travel time from the Headquarters to Panther Swamp or Morgan Brake NWRs is approximately 1 hour. Four refuges remain unstaffed (Holt Collier, Theodore Roosevelt, Mathews Brake, and Hillside NWRs) and management activities on these refuges must be accomplished by sending staff from Yazoo and Morgan Brake NWRs.

Due to the lack of adequate personnel and funding, growth for new refuge programs has been halted and refuge management has been negatively affected. Baseline information on species is absent, needed maintenance has been delayed, and the ability to reach out to the public with visitor services and facilities is minimal. To implement this CCP and accomplish the vision identified for this Complex, additional staffing and funding are needed (Table 16).

Panther Swamp NWR has the greatest need for additional staff. Thirty one percent of the identified staff needs in Table 16 are located at Panther Swamp, followed by Hillside (18 percent), Yazoo (18 percent), Morgan Brake (13 percent), and Mathews Brake (10 percent). The top three staffing needs are for biological technicians, refuge managers, and law enforcement officers.

Strategies:

- Increase refuge staff positions to implement programs needed to address and/or resolve the issues addressed in this plan.
- Provide continuing education and training opportunities to all staff.
- Provide safe and efficient equipment and vehicles to perform needed refuge operations and maintenance.
- Provide up-to-date computer-based systems to perform refuge operations and planning functions.
- Provide training to refuge staff on computer-based systems to ensure all data is stored in a manageable, retrievable database that can be used for analysis and data sharing.

Table 16. Additional staff needed to implement the Comprehensive Conservation Plan for the Theodore Roosevelt National Wildlife Refuge Complex

Position	Full-time Equivalents (FTEs)	Refuge Office
Refuge Operations Specialist	9	Complex Headquarters (1), Yazoo (2), Panther Swamp (2), Hillside (1), Morgan Brake (2) Mathews Brake (1)
Forester	2	Panther Swamp (1), Yazoo (1)
Forestry Tech	1	Complex Headquarters (1)
Park Ranger (Law Enforcement)*	6	Yazoo (2), Panther Swamp (1.5), Morgan Brake (1), Hillside (1), Mathews Brake (.5)
Outdoor Recreation Planner	2	Complex Headquarters (1), Yazoo (1)
Outdoor Recreation Specialist	1	Hillside (1)
Park Ranger (Interpretive)	1	Complex Headquarters (1)
Refuge Planner	1	Complex Headquarters (1)
GIS/IT Specialist	1	Complex Headquarters (1)
Biological Technician**	8	Yazoo (1), Panther Swamp (2), Hillside (2), Morgan Brake (2), Mathews Brake (1)
Wildlife Biologist	3	Yazoo (1), Panther Swamp (1), Hillside (1)
Secretary/Receptionist	3.5	Complex Headquarters (1), Panther Swamp (1.5), Morgan Brake (1)
Equipment Operator**	2	Panther Swamp (1), Morgan Brake (1)
Maintenance Worker	2	Panther Swamp (1), Yazoo (1),
TOTAL FTEs	42.5	Complex Headquarters (17%), Yazoo (21%), Panther Swamp (27%), Hillside (12%), Morgan Brake (17%), Mathews Brake (6%)

Assumes 2003 level of collateral duty officers

Objective 7C: Provide highly trained and effective law enforcement personnel to ensure trust resource protection, visitor safety, and enforcement of all refuge related acts and regulations.

Discussion: The Refuge System consists of more than 544 refuges and 37 wetland management districts. The Refuge System manages over 96 million acres, in every state and several territories. Visitation is increasing at an annual average of 6.6 percent. Given current trends, 2.3 - 2.4 million additional people will visit national wildlife refuges over the next several years.

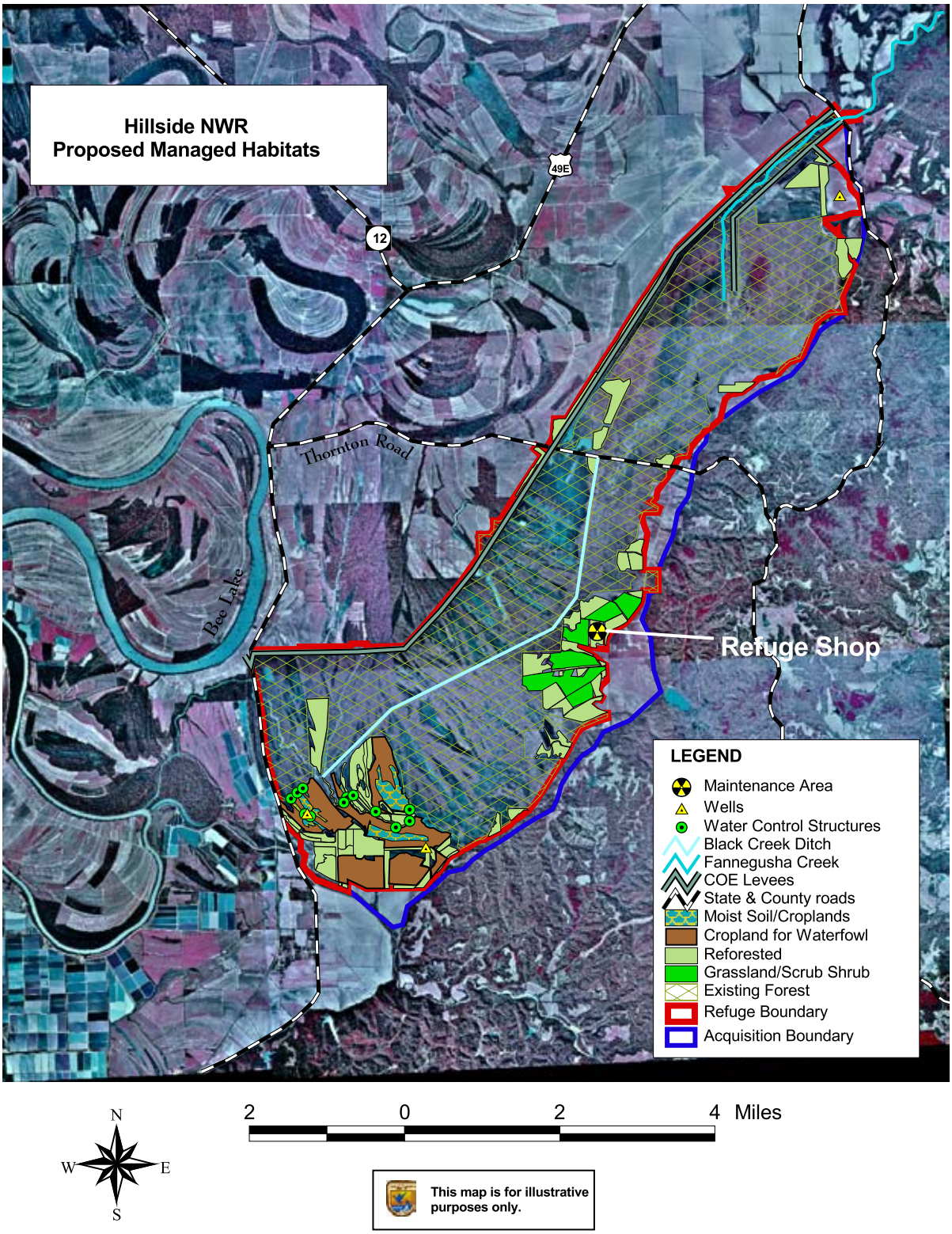
Protecting the natural resources of the Complex and ensuring the safety of refuge visitors are fundamental responsibilities of the Refuge System. In 2003, the Complex law enforcement program consisted of one full-time law enforcement park ranger, six dual-function officers, and two seasonal dual-function officers. In 2004, staff shortages reduced the LE staff to five, one full-time Park Ranger and four dual function officers whose primary function varies from biological technical duties to heavy equipment operation. During periods of high public use such as hunting seasons, the majority of dual-function officers' time is spent conducting law enforcement activities, many times at the sacrifice of other equally crucial functions.

This 15-year CCP recommends a substantial increase in public use facilities and infrastructure to accommodate increasing numbers of visitors. Visitation will also continue to grow on its own. This will increase the need for effective and adequate law enforcement so that visitors enjoy a safe and pleasant experience on Complex lands, and to ensure resource protection. Additional full-time law enforcement officers are necessary to accomplish these goals.

Strategies:

- Provide four (combined total) full-time law enforcement park rangers, GS-7, at Yazoo, Panther Swamp, Hillside, and Mathews Brake NWRs.
- Provide a minimum of 5 dual function officers to assist during heavy public use period and provide backup for full-time officers.
- Provide two seasonal law enforcement park rangers, GS-5, during high public use periods, such as hunting seasons.
- Provide up-to-date training and equipment for law enforcement officers.
- Develop Memorandums of Understanding with state and local law enforcement agencies to facilitate cooperation and assistance in law enforcement activities.
- Provide education and outreach programs in the local community as part of a preventive law enforcement effort.
- Provide assistance to Service Special Agents and Mississippi Department of Wildlife, Fisheries and Parks conservation officers for off-refuge activities as needed and appropriate.

Figure 17. Proposed managed habitats of Hillside National Wildlife Refuge



2 0 2 4 Miles

This map is for illustrative purposes only.

Figure 18. Proposed managed habitats of Panther Swamp National Wildlife Refuge

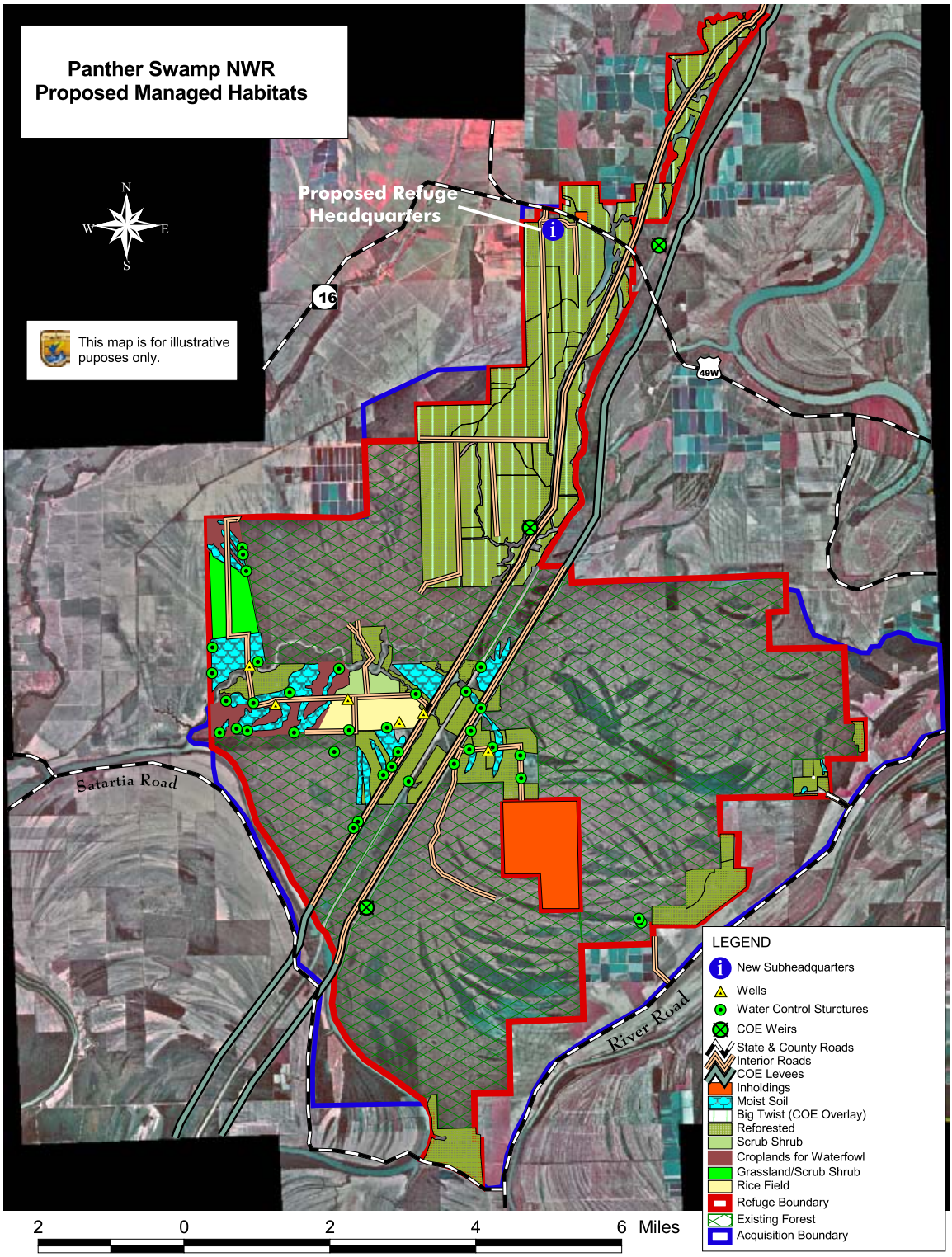


Figure 19. Current and proposed managed habitats of the Panther Swamp National Wildlife Refuge Northern Unit (Carter Tract).

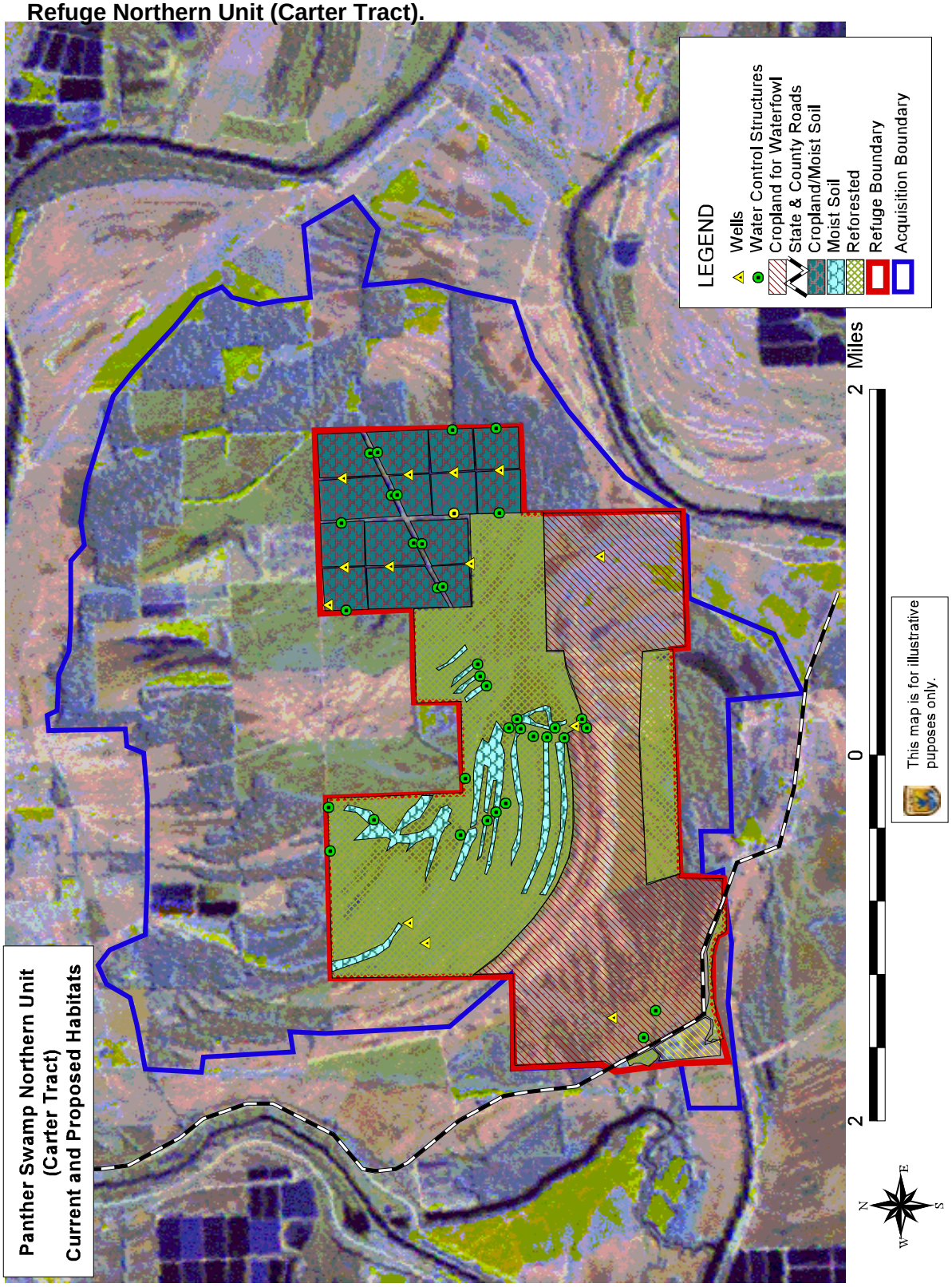


Figure 20. Proposed managed habitats of Mathews Brake National Wildlife Refuge

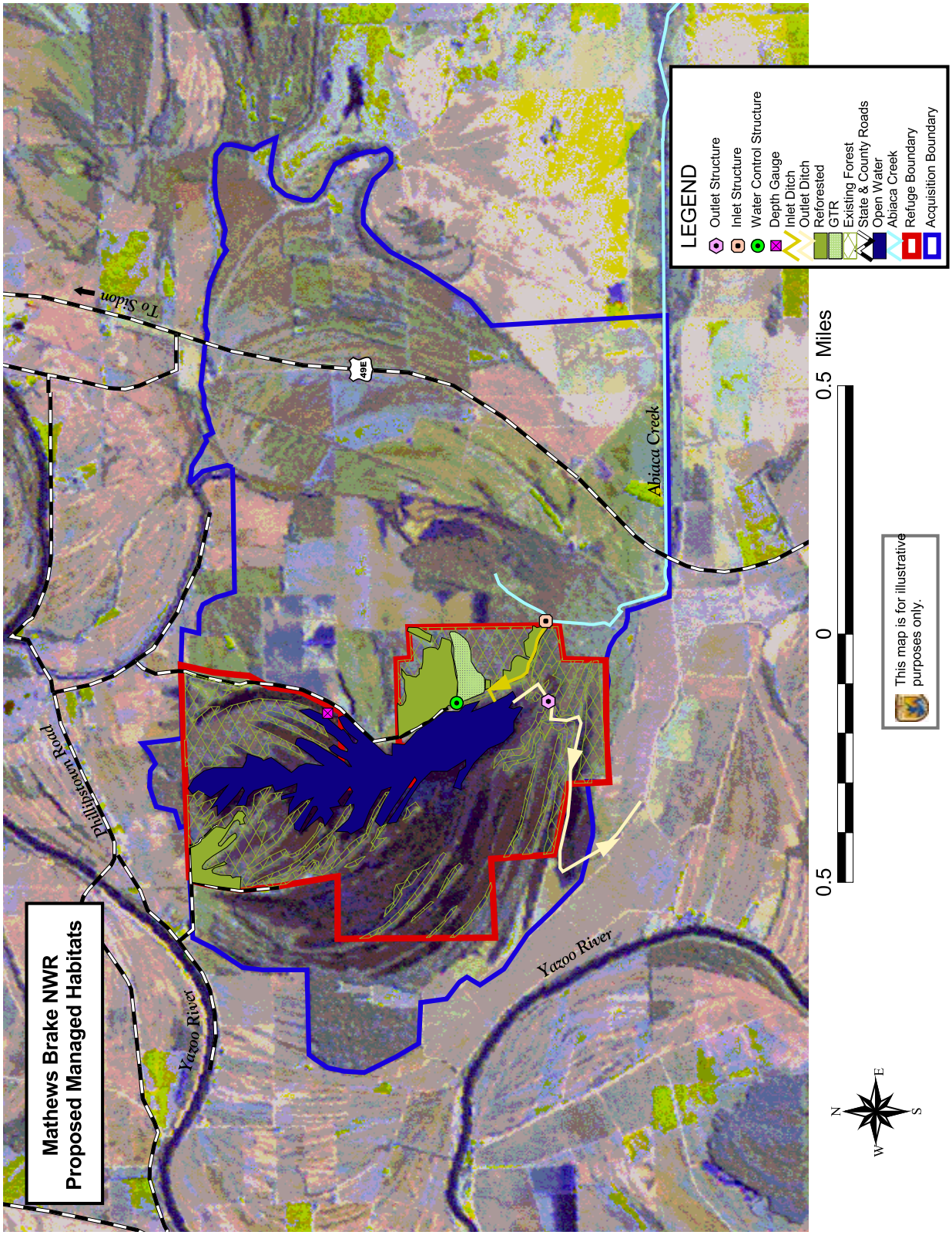


Figure 21. Proposed managed habitats of Morgan Brake National Wildlife Refuge

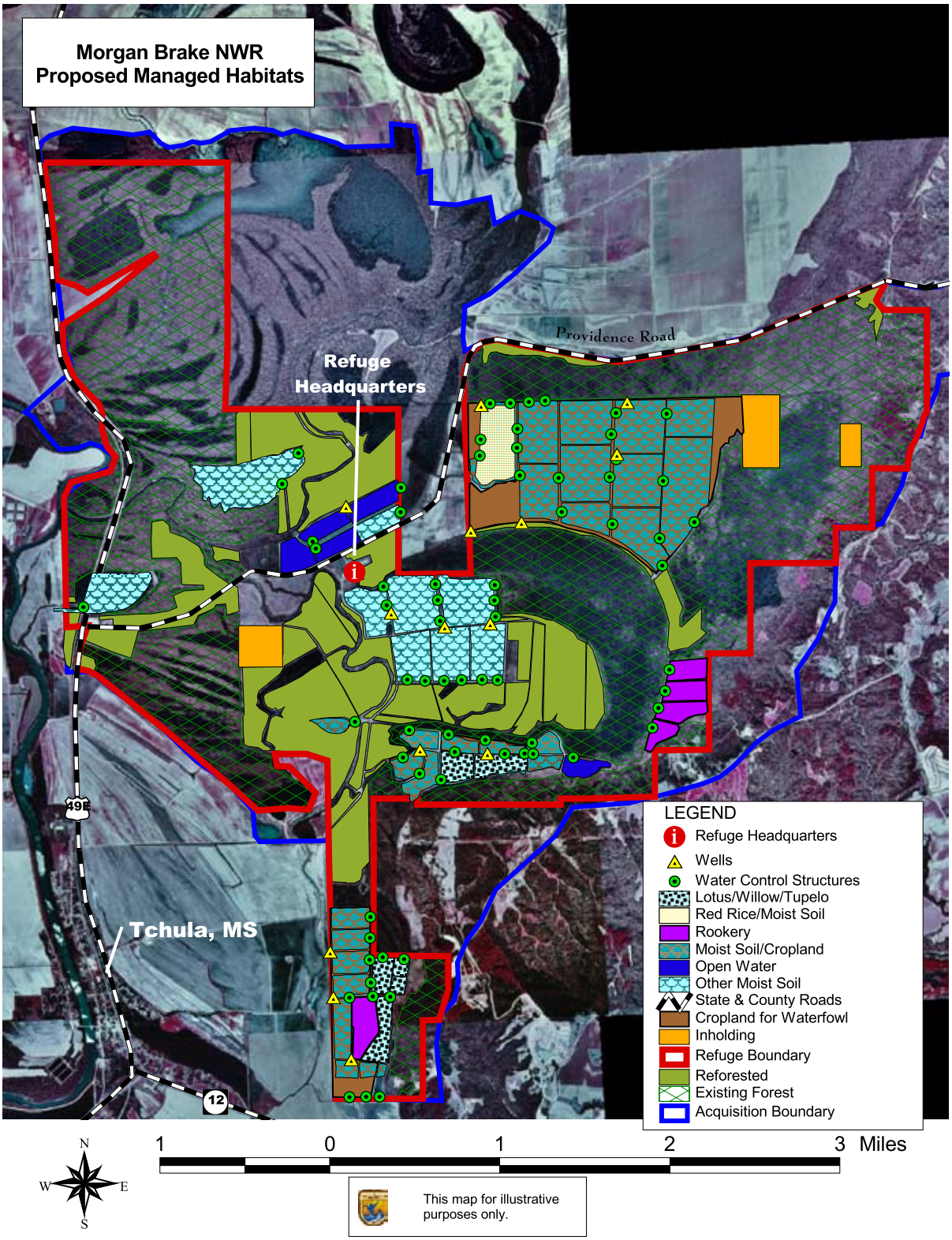


Figure 22. Proposed managed habitats of Yazoo National Wildlife Refuge

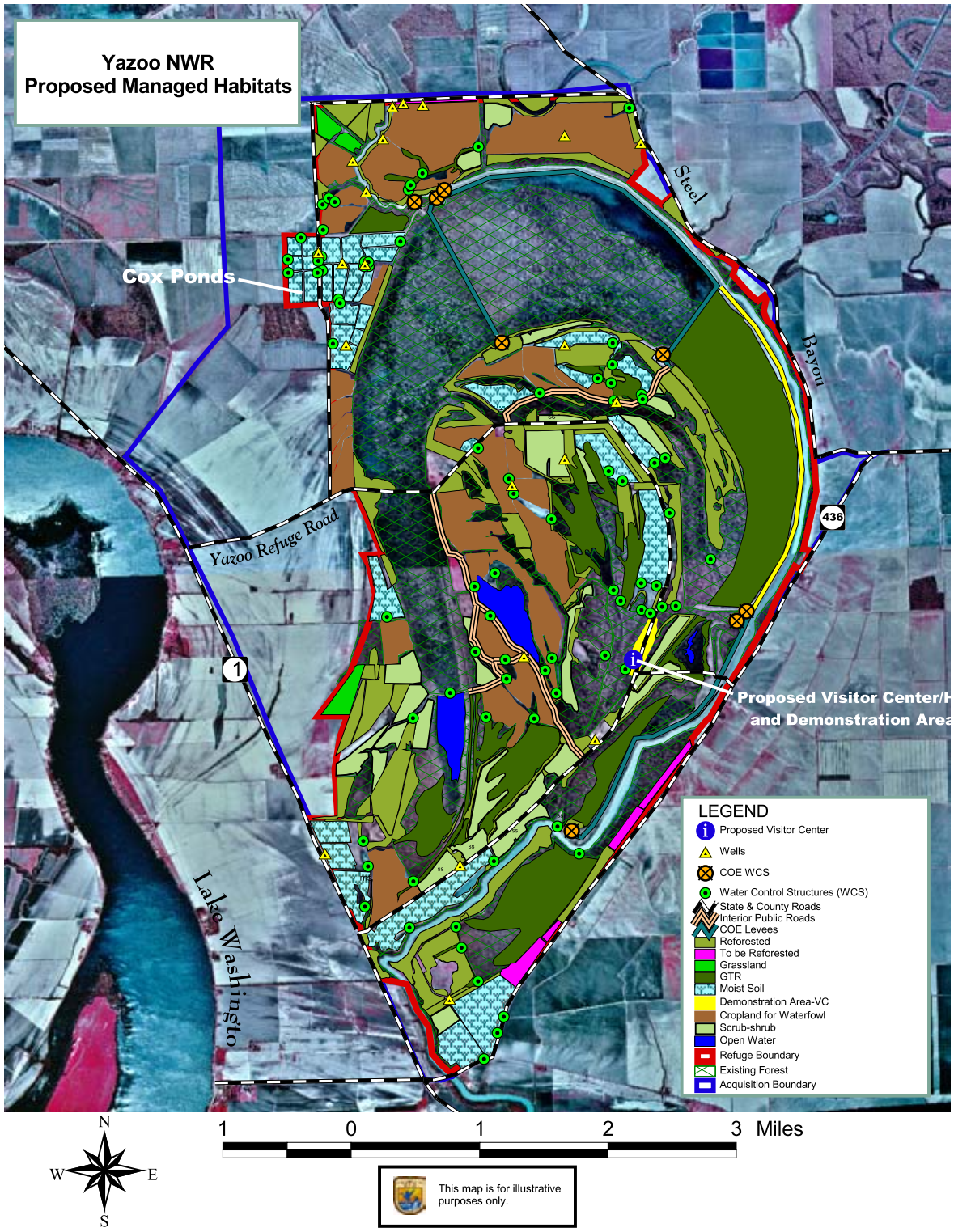


Figure 23. Proposed visitor services for Hillside National Wildlife Refuge

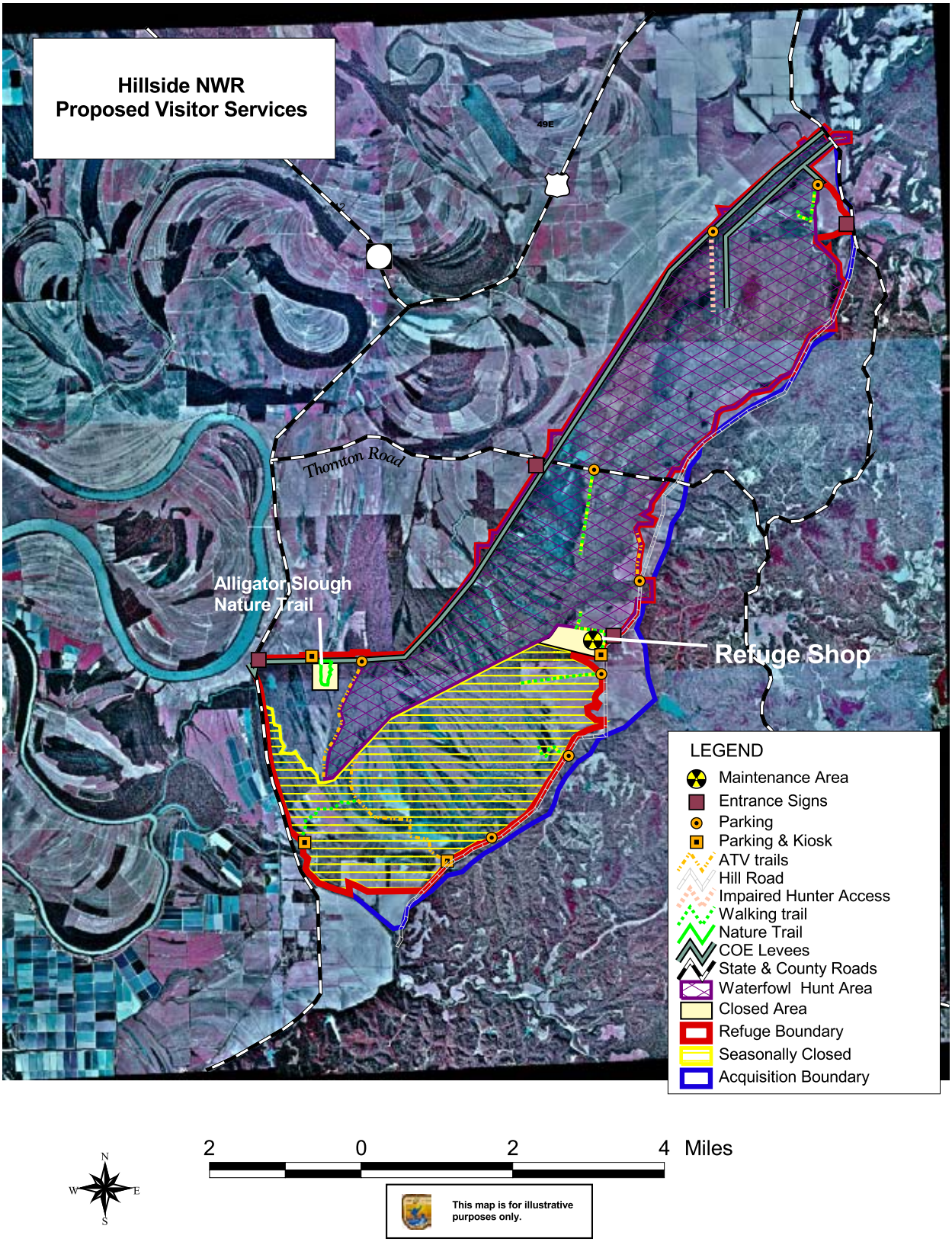


Figure 24. Proposed visitor services for Panther Swamp National Wildlife Refuge

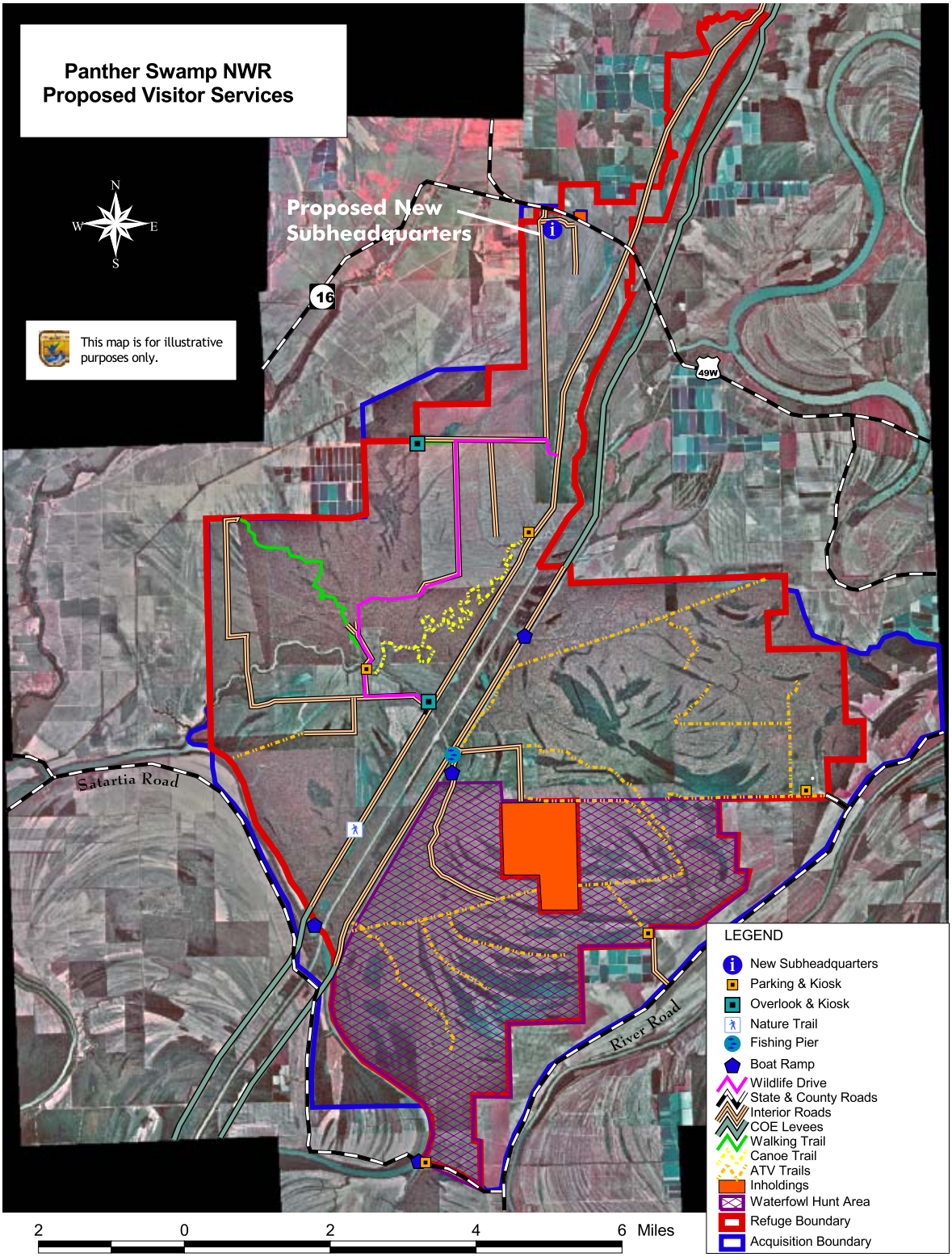


Figure 25. Proposed visitor services for Mathews Brake National Wildlife Refuge

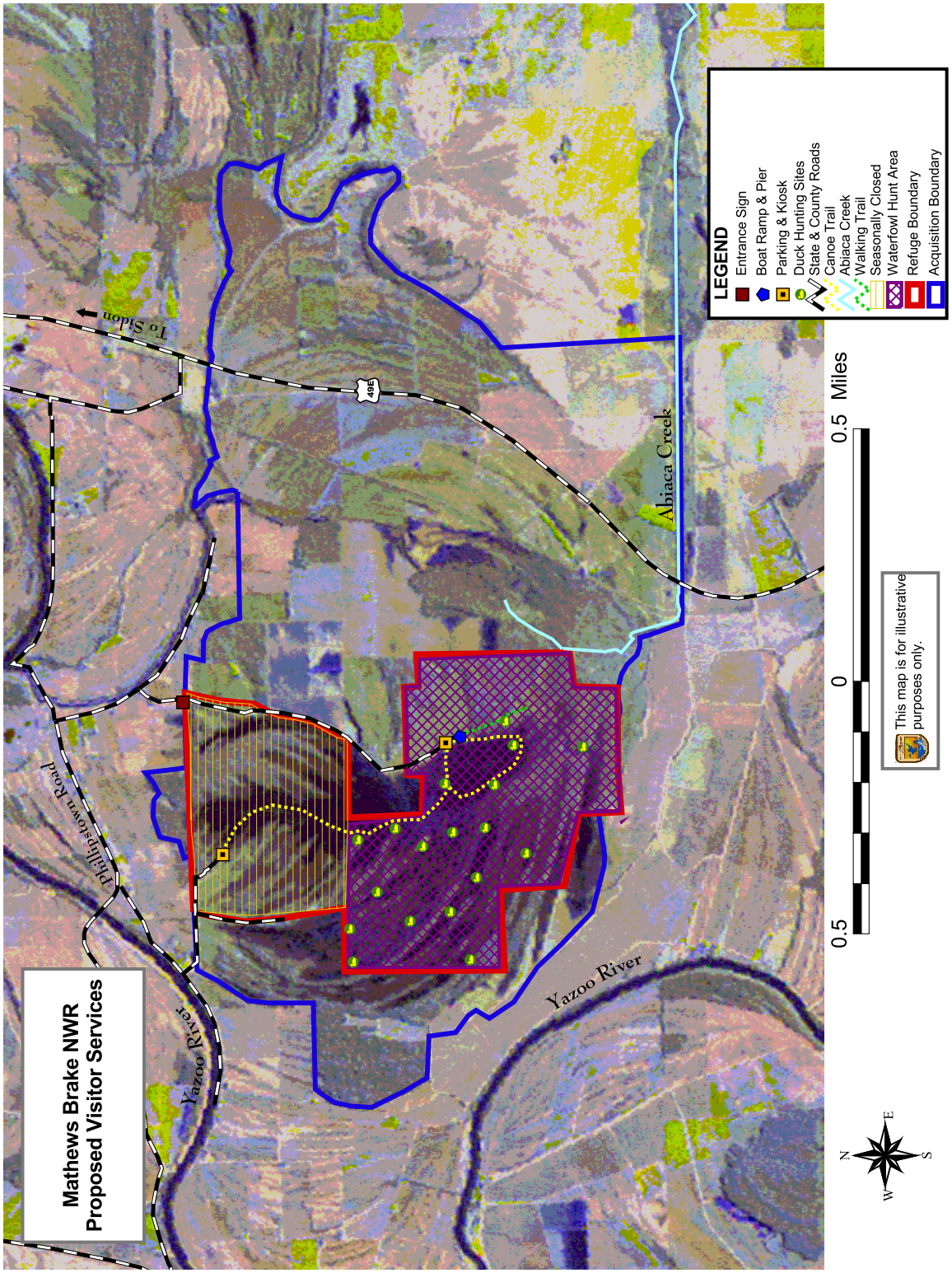


Figure 26. Proposed visitor services for Morgan Brake National Wildlife Refuge

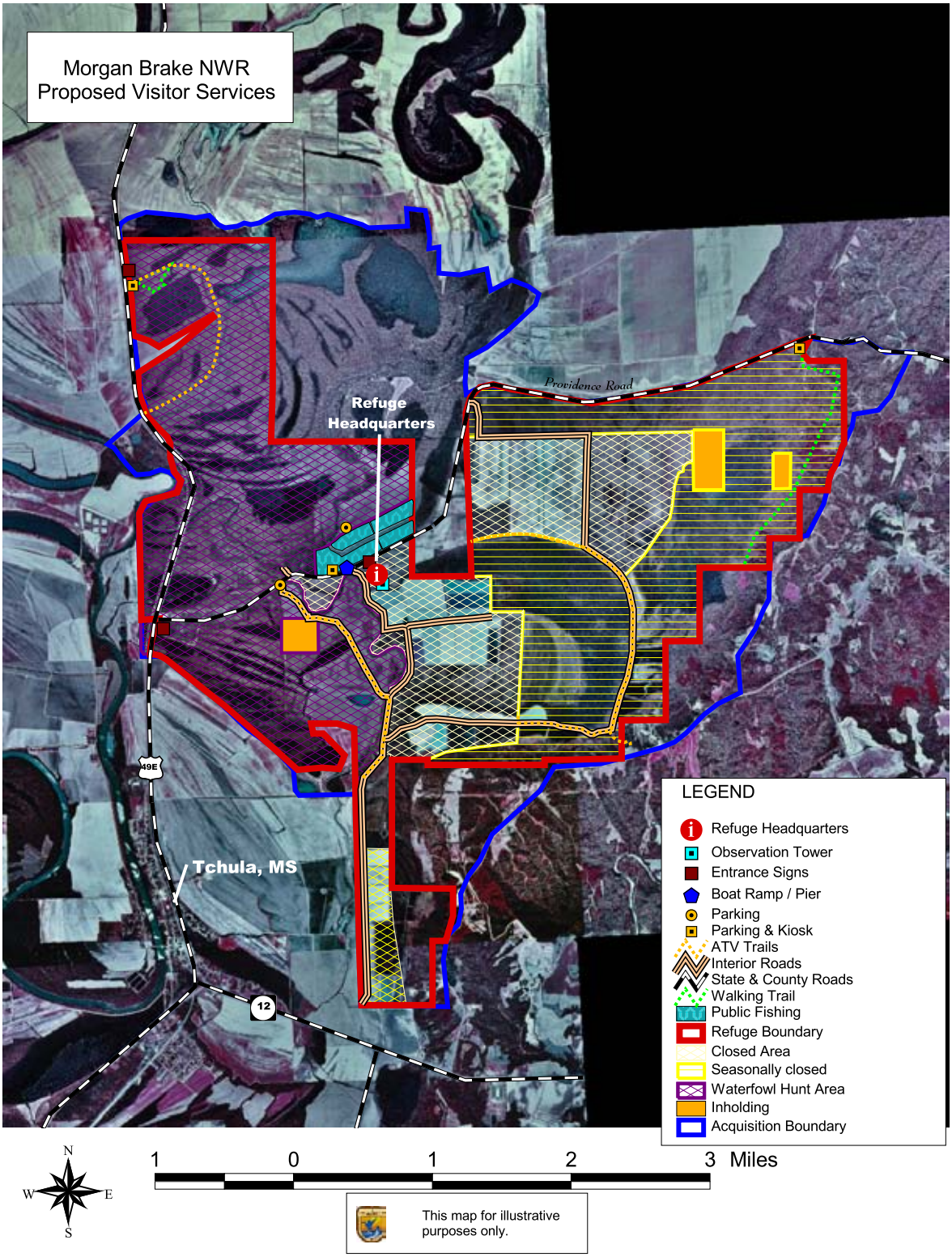
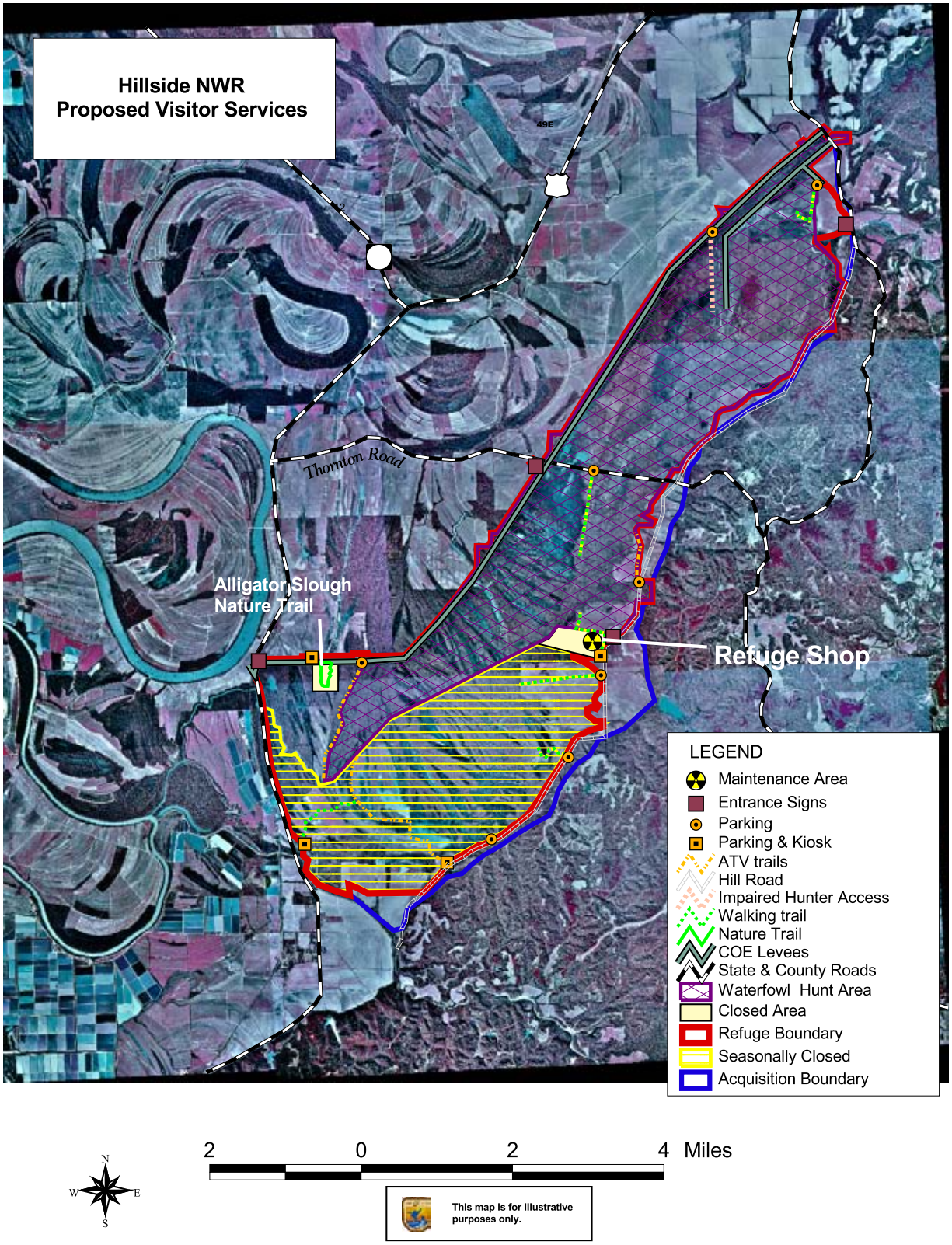


Figure 27. Proposed visitor services for Hillside National Wildlife Refuge



V. Plan Implementation

INTRODUCTION

The goals and objectives outlined in Chapter IV addressed specific refuge management needs for habitat and species management, research and monitoring, land protection, cultural resources, visitor services, and administration on over 90,000 acres of land in the Theodore Roosevelt NWR Complex. Habitat management will be tailored to meet priority species' needs (waterfowl and other migratory birds), while meeting the needs of other fish and wildlife dependent upon refuge lands. Because the rate at which each refuge in the Complex achieves its full potential is dependent on the level of resources that are invested, wildlife populations that are locally, regionally, and nationally important may be delayed until staffing and funding are adequate to meet the identified needs. Proposed priority public use programs that would establish and expand opportunities for wildlife-dependent public recreation cannot be implemented and accomplished without specialized staff and substantial funding increases. (Note: This plan does not constitute a commitment from Congress for staffing increases, operational and maintenance increases, or funding for future land acquisition.)

PROPOSED PROJECTS

The following proposed projects reflect high priority needs identified by Service staff, the public, and the planning team members for ***habitat and species management, non-native invasive and nuisance species management and control, research and monitoring, land protection and conservation, cultural resources, visitor services, and administration*****.** The projects are not ranked in priority order. Project plans may be revised as new data become available, funding and staffing levels fluctuate, and adaptive management strategies are implemented.

Annual funding requests for new projects or personnel that are needed to implement the goals, objectives, and strategies outlined in this CCP will be included in the Refuge Operating Needs System (RONS), a national database which contains unfunded operational needs for each refuge. Projects for new equipment, road projects, required maintenance and other refuge management needs will be included in the Maintenance Management System (MMS) Database, a computerized database and management tool used for planning and budgeting maintenance, capital improvements, and equipment replacement.

Substantial changes in habitat management may be needed over time, as new information becomes available and habitat conditions evolve. These changes will be included in CCP revisions. Step-down plans (not included in this CCP) will be developed in conjunction with future Visitor Services Program Plans and Forest Management Plans, among others.

HABITAT AND SPECIES MANAGEMENT

The Complex provides a diversity of habitats for resident and migratory species, including moist- soil, wetlands and aquatic sites, cropland, forestlands, and scrub/shrub habitats. Four refuges in the Complex were established primarily for migratory birds with an emphasis on waterfowl. However, Panther Swamp, Hillside, and Morgan Brake NWR's purposes include other fish and wildlife, recreation and endangered species purposes in their establishing legislation. With that in mind, the following projects for habitat and species management have been identified as high priority needs for the complex:

Project 1 - Cultivate partnerships with the COE, Natural Resources Conservation Service (NRCS), and others to identify and implement measures to resolve habitat issues associated with water management.

- Yazoo NWR - work with the COE to ensure that the Swan Lake project (COE Steele Bayou project) functions as designed.
- Yazoo NWR - work with the COE to minimize habitat impacts during the COE's completion of the Swan Lake (COE Steele Bayou) project.
- Yazoo NWR - work with the COE to raise the elevation of Weir E by one foot to ensure gravity flow of water into Swan Lake.
- Panther Swamp NWR - work with the COE to develop plans for lowering the weir at Landside Ditch above Cotton's bridge to increase water velocity, thereby reducing siltation and issues associated with beaver dams in sloughs on the east side of Panther Swamp NWR.
- Hillside NWR - work with the COE and NRCS to address siltation from upland sources.
- Hillside NWR - work with the COE to resolve siltation and flooding issues associated with Tcheva Creek.
- Morgan Brake NWR - work with NRCS to resolve the flooding issues associated with Chicopa Creek.
- Work with private landowners, tribes, corporations, industry, and others through the Partners for Fish and Wildlife Program to restore wetlands, improve fisheries, and enhance habitat to resolve issues associated with water management.
- Work with private landowners through the Mississippi Partners Program to provide water on private lands during the winter migration season.

Project 2 - On Morgan Brake NWR divert a gravel road 200 feet away from the North Hill Ponds spring, and restore a 200-foot zone surrounding the spring by planting native shrubs.

Morgan Brake NWR contains a coldwater spring adjacent to the North Hill Ponds that currently lies only 10 feet off the gravel road. **Initial costs to re-route the road are estimated at $10,000 with recurring annual costs of $1,000 per year.**

Project 3 - Control beaver populations to ensure that no more than 5 percent of bottomland hardwoods is converted to aquatic sites.

Refuge lands in the Complex contain extensive wetland acreage with varying sources and duration of hydrology, from deepwater swamps to bottomland hardwood forests. Panther Swamp NWR contains the largest contiguous block (20,000 acres) of bottomland hardwoods in the Complex. However, beaver have constructed dams that hold water and kill trees. Although beaver ponds do provide good habitat for some waterfowl and aquatic species (wading birds, reptiles, amphibians), forest losses have been substantial. Beaver suppression is required on all refuges in the Complex. **In addition to costs associated with employing Biological Science Technicians and associated personnel to conduct the work, annual beaver suppression costs are estimated at $40,000.**

Project 4 - Provide and protect habitat for threatened and endangered species on Complex lands (i.e., interior least tern, bald eagle, pallid sturgeon, pondberry, and Louisiana black bear).

Interior Least Tern: Interior least terns have historically bred and nested from late April to August on barren and sparsely vegetated sandbars, and sand and gravel pits along the Mississippi, Missouri, Ohio, Red, and Rio Grande Rivers. They feed in shallow waters on fish, insects, crustaceans, mollusks, and annelids (Whitman 1988). However, river channel alterations for navigation, hydropower, irrigation, and flood control have destroyed their nesting and breeding habitat. Many remaining sandbars are unsuitable for nesting due to vegetation encroachment or frequent flooding. In 1985, interior least terns were placed on the Endangered Species List in many states, including Mississippi, and the Fish and Wildlife Service developed the recovery plan in 1990.

Small numbers of interior least terns forage in Swan Lake on Yazoo NWR in the summer. Interior least terns have been known to breed along the Mississippi River in Washington County in the vicinity of Yazoo NWR, and have been observed foraging at Yazoo and Morgan Brake NWRs by refuge staff. Since Yazoo NWR lies only 4 miles from the Mississippi River, efforts to provide habitat for interior least terns would be more likely to benefit the nearby Mississippi River populations. On Yazoo NWR, an opportunity exists to provide summer foraging habitat at the Cox Ponds moist soil areas, if a suitable forage species can be provided in the management scheme.

Bald Eagles: Bald eagles are becoming more frequent sightings throughout the Complex and nesting has been documented in Lake Washington only 2 miles from Yazoo NWR. However, no nests have been identified on any of the refuges in the Complex. To encourage bald eagle nesting, super-dominant trees will be protected at the edges of lakes and streams to provide nesting habitat.

Pallid Sturgeon: Pallid sturgeon (*Scaphirhynchus albus*) are bottom-feeding fish that prefer large, muddy rivers with rocky or sandy bottoms. They are known to occur in the Yazoo River, adjacent to Panther Swamp NWR, where they can be found in backwaters, side channels, sloughs, and in the main channel. Historically found throughout the Missouri River from Montana to the Mississippi River and south to Louisiana, virtually all of the pallid sturgeon's habitat has been altered by dams, reservoirs, and channelization projects. The Complex will protect pallid sturgeon and their habitat and minimize threats from existing and proposed activities.

Pondberry: Pondberry (*Lindera melissifolia*) is a deciduous shrub that grows to about 2 meters in height. Yellow flowers in early spring yield a fleshy, bright red drupe in fall. This endangered shrub grows in bottomland forests, poorly drained depressions, and in limestone sinks. Habitat loss is the primary threat to the continued existence of this species. Pondberry has been introduced in experimental populations on Yazoo NWR. The Complex will work with the Service’s Jackson, Mississippi, Ecological Services Office to identify natural pondberry colonies on Complex lands, protect the existing colonies that have been introduced as experimental populations, and provide suitable habitat for additional pondberry introductions.

Louisiana Black Bear: The Louisiana black bear is a threatened species that historically occurred throughout the central and south part of Mississippi and was reportedly common in the southern portion of the LMRAV. Habitat loss through lands converted to agricultural fields and excessive harvest throughout its range has seriously reduced populations. The Complex will work with state bear restoration groups and others to help implement a education and training program, manage habitat on public and private lands to support the recovery of the Louisiana black bear, and participate in repatriation efforts at Panther Swamp NWR and other areas within the lower Mississippi Delta. **In addition to personnel costs, habitat management and education/training costs are estimated at $35,000 annually.**

Project 5 - Waterfowl: Provide a minimum of 4,500 acres of moist soil/shallow water habitat for waterfowl to support national and regional plans.

In order to meet the 19.1 million duck-use-day minimum objective in national and regional plans, including the North American Waterfowl Management Plan, appropriate Complex lands will be managed to provide habitat, food resources, and sanctuary for ducks. Currently, the Complex manages 2,439 acres of moist soil. To expand moist-soil habitats for waterfowl, the Complex will increase moist-soil acreage by 2,066 acres within current acquisition boundaries. This would involve the development of site plans, construction of berms and levees, and water control structures in addition to increased management and maintenance to manipulate water levels. The moist-soil areas will encourage the growth of moist-soil plants for seed production and encourage invertebrates that will provide a food resource for a variety of wetland-dependent migratory birds. **To manage 4,505 acres of moist-soil/shallow-water habitat, initial costs are estimated at $250,000 with a recurring annual cost of $150,000.**

Project 6 - Shorebirds: Provide a minimum of 435 acres of shallow water habitat for fall shorebird migration.

Shorebirds forage in mud flats and other moist-soil areas. Peak northbound migration occurs from March to mid-May. Existing habitat for northbound migration is considered adequate in the LMRAV. Southbound migration starts in early July, peaks August through September, and tapers off toward winter, usually lasting until at least the end of October. Severe shorebird habitat shortages occur when shallow-flooded or mudflat habitats are unavailable in late summer/fall.

For Mississippi, a 1,500-acre habitat target that would support a tentative 500,000 LMRAV population objective has been established for southbound migration. This objective is based on conservative assumptions, and experts believe that the figure may be as much as twice that estimated. Because shorebird habitat is one of the highest non-game bird priorities for the Complex, existing shorebird management practices will be continued, and opportunities for improvement will be implemented. **Costs to accomplish these habitat management strategies are estimated at $30,000 annually.**

Project 7 - Colonial Waterbirds: Provide habitat to support a minimum of five colonial waterbird rookeries on Complex lands.

Deepwater wetland habitats on refuge lands in the Complex have supported several colonial waterbird rookeries for many years, including two rookeries on Yazoo NWR, a small rookery on the south side of Morgan Brake NWR, and a rookery on Hillside NWR. Foraging habitat for wading birds is present in wetlands throughout the Complex, but particularly in intensively managed moist-soil areas on Yazoo and Morgan Brake NWRs. Hundreds of wading birds gather to feed in the spring and summer, especially during drawdown phases. The Complex will continue to protect colonial waterbird rookeries or roosts and provide foraging habitat to support colonial waterbirds. **In addition**

to staff time, costs are estimated at $5,000 for surveys and approximately $5,000 annually for potential easements.

Project 8 - Wood ducks: Provide brood habitat and nest sites to support 3,000 hatchling wood ducks each year on Complex lands.

Today wood ducks are common LMRAV residents, largely due to the introduction of wood duck nest boxes in preferred habitats. Although wood ducks may seek cavities in trees within a mile of water, brood survival is higher where nests are closer to water. Preferred habitats include forested wetlands, wooded and shrub swamps, tree-lined rivers, streams, sloughs, and beaver ponds. Wood ducks seek acorns, other soft and hard mast, weed seeds, and invertebrates in shallow flooded timber, shrub swamps, and along stream banks. They loaf and roost in more secluded areas and dense shrub swamps.

Currently over 250 nest boxes are maintained and checked annually. Many studies have been conducted over the years on the Yazoo NWR wood duck nest box program. During most years the wood duck nest box program has been successful, with some nests used 3 and 4 times during the nesting season. The Complex will provide year-round habitat and maintain a minimum of 300 nest boxes throughout the Complex to enhance wood duck populations and maintain sufficient water levels for brood habitat from July through November. **The proposed wood duck nest box program initial start-up costs for an expanded program are estimated at $25,000 with annual recurring costs of $40,000. This amount includes funding for a Biological Science Technician.**

Project 9 - Reptiles: Maintain a population of at least 700 alligators, and protect habitats for turtles, snakes, lizards, and crocodilians on Complex lands.

The American Alligator (*Alligator mississippiensis*) was previously listed on the Endangered Species List due to over-harvest and habitat loss. Populations increased with legislated protection, and the alligator was removed from the list in 1987. No surveys have been conducted to identify the numbers of alligators on refuge lands. However, the Project Leader has gained knowledge of the numbers of alligators during his 24 years on the Complex and he estimates that approximately 700 alligators reside on refuge lands. Since the alligator can be considered a keystone species, the protection of habitat for alligators would also provide habitat for turtles, snakes, and lizards. The Complex will map the locations of alligator nesting sites, protect alligator nesting sites from disturbance, and manage water levels to support alligators on Complex lands. **Initial start-up costs are estimated at $10,000 with recurring annual costs of $5,000.**

Project 10 - Amphibians: Maintain existing habitat and breeding sites to support resident amphibians on Complex lands.

Identifying and conserving breeding sites for amphibians, especially salamander species, is vital for their reproductive success. Because salamanders are less mobile than frogs and toads, they are more likely to be impacted by losses in their breeding sites. To maintain and improve reptile and amphibian diversity, and to ensure that habitat is managed for all native species, breeding sites should be identified and conserved, especially for salamander species that are in decline. The Complex will map breeding sites for amphibian species, conserve breeding areas, and establish buffer zones to protect habitat from pesticide or silt contamination. **Initial start-up costs are estimated at $10,000 with recurring annual costs of $5,000.**

Project 11 - Fish: Maintain and/or enhance a minimum of 2,000 acres of deepwater aquatic habitat for viable fishery.

Fish are an important component of the Lower Mississippi River Ecosystem. Historically, the ecosystem supported a great diversity of fish adapted to the seasonal flooding of a large river. The inherent productivity of the fishery has changed, due to hydrological alterations that have isolated habitats outside the main river levees. The resultant habitat favors species of fish that are less adapted to riverine habitats with dynamic seasonal flooding regimes. Because it is not possible to reestablish or mimic the river's influence on the majority of the Complex's aquatic habitats, existing deepwater areas will be managed to provide a quality fishery that will likely be appropriate in many instances for public fishing. **Initial start-up costs are estimated at $15,000 with recurring annual costs of $5,000.**

Project 12 - Provide agricultural grains for waterfowl and other wildlife

"Farming has been an important management practice in the MAV since the first waterfowl refuges were established during the 1930s. Crop production provides the greatest yield of waterfowl food per unit area" (Reinecke et al., 1989). Cooperative farming, an arrangement where refuge land is provided to a farmer in exchange for a portion of the crop, has long been the most economical method for meeting refuge crop objectives. To support the North American Waterfowl Management Plan, the minimum habitat objective for unharvested small grain crops is approximately 1,100 acres for the entire Complex. **To meet waterfowl objectives, provide 2,860 acres of agricultural crops for ducks Complex wide: 1,100 acres for waterfowl; 1,200 contiguous acres for geese on Yazoo NWR; green browse to over-winter migratory Canada, white fronted, and snow geese; and 660 acres to compensate for the acres of grains lost to overpopulations of snow geese.**

Project 13 - Manage a minimum of 42,000 acres of mature forest for native resident and migratory species.

Bottomland hardwood forests provide a complex of habitats, including temporarily and seasonally flooded bottomland hardwoods, and permanently and semi-permanently flooded shrub and wooded swamps. Forested wetlands provide food resources in the form of hard mast (such as acorns and other nuts), an important and vital component of wildlife food needs. Historically, mallards wintering in the MAV satisfied most of their habitat requirements in forested wetlands. A complex of natural habitats enabled mallards to feed on acorns and invertebrates in flooded forests or on seeds of moist-soil plants in beaver swamps and slough margins, to roost and court in more open marshes and sloughs, and to escape predation and social harassment in shrub swamps" (Reinecke et al., 1989). Additional staff will be needed to implement the current forest management plan and develop new plans to cover future management efforts. **Two additional GS-7/9 foresters would be needed with a first year cost of $220,000 and a recurring annual cost of $150,000.**

Project 14 - Provide and maintain a minimum of 1,500 acres of scrub/shrub habitats for ground-nesting birds and migratory songbirds.

Habitat management efforts will focus upon priority species that rely upon scrub/shrub habitats for breeding, foraging, nesting, and cover. Scrub/shrub habitat will be created with plantings and habitat manipulation (per Twedt recommendations.) After establishment, the habitat will be mowed, disked, and burned to maintain the necessary successional stage. **Initial costs are estimated at $50,000 with a recurring annual cost of $20,000.**

Project 15 - Maintain existing and provide a minimum of 500 acres of new habitat for grasslands species

Priority grassland species occupy refuge lands primarily during migration periods and winter, although a few species may breed in small numbers throughout the year. Newly reforested areas, levees, and converted agricultural lands constitute the majority of grassland habitats on the Complex. New grassland habitat will be established as agricultural acreage is reduced complexwide. Former agricultural lands will be planted to warm season native grasses. Habitat maintenance (e.g., mowing, burning, and disking) will be required on a regular basis to maintain grassland habitat. **Initial costs are estimated at $20,000, with annual recurring costs of $20,000.**

Non-native and Native Invasive Species Control and Management and Pest and Nuisance Animal Control and Management

Project 16 - Eradicate or control non-native or native invasive species, pest species, and nuisance animals.

Numerous non-native invasive species are known to occur on refuge lands in the Complex. Some have caused damage to important wildlife habitats or species. Feral swine on Morgan Brake, Mathews Brake, Hillside, and Panther Swamp NWRs destroy habitat by rooting up vegetation and trees in forests and deplete acorn mast, a preferred food for waterfowl and other native species, and transmit diseases such as pseudorabies to other wildlife. Feral swine also destroy water control structure levees and crops. Yazoo, Hillside, and Morgan Brake NWRs have populations of nutria, armadillo, coyote, alligator weed, and kudzu that damage habitat for native species. Management efforts will emphasize the eradication of non-native and native invasive species, and the eradication and control of pest species and nuisance animals on all Complex lands. Costs associated with this project include funding for herbicides, spray equipment, trapping equipment, and personnel to develop a plan and conduct the work. **Start-up costs and staff for an invasive and nuisance animals eradication and control program are estimated at $250,000-300,000 with recurring annual costs of $200,000-250,000.**

Research and Monitoring

Project 17 - Expand Complex's research and monitoring program to ensure that management decisions continue to be based upon sound science.

To apply adaptive techniques to habitat management on refuge lands, specific survey, inventory, and monitoring protocols will be needed. This information will be used to refine approaches and determine how effectively the objectives are being accomplished. Evaluations will include LMVJV, ecosystem team, and other appropriate partner participation. If monitoring and evaluation indicate undesirable effects for target and non-target species or communities, then alterations to the management projects will be made. Subsequently, the CCP will be revised.
Specific monitoring and evaluation activities will be described in the step-down management plans (if needed). Because funding is limited, most research and monitoring would likely be conducted by visiting researchers and scientists. However, systematic surveys can identify the presence and distribution of priority wildlife species and provide baseline data to assist managers in habitat management practices. To gather this data, the Complex is proposing to add additional biological staff. Baseline data collection and studies will require additional staff and support from partnering federal and state agencies, conservation organizations, universities, and scientists. **The estimated first-year cost of this project is $500,000 with a recurring cost of $300,000-400,000 per year.**

LAND PROTECTION AND CONSERVATION

A major objective of the CCP is to establish partnerships with local volunteers, landowners, private organizations, and state and federal natural resource agencies to accomplish mutual goals and objectives.

Project 18 - Provide technical and financial assistance for habitat restoration to private landowners and non-governmental conservation organizations through the Partners for Fish and Wildlife Program and the Mississippi Partners Program.

Private lands are important components to the restoration and reestablishment of native habitats. Although the historically diverse fish and wildlife resources of pre-settlement America cannot be restored entirely, habitat restoration on private lands is important to the process. Objectives in national and regional plans such as the North American Waterfowl Management Plan, Partners-in-Flight Plan, Mississippi River Alluvial Valley Bird Conservation Plan and Strategic Fisheries Plan will be emphasized. The Complex will seek projects focusing on cropland enhancements for wintering waterfowl and reforestation projects on at least 2,000 acres of private lands within the 9-county private lands program focus area. Additional staff would be needed to expand the existing private lands program. **Start up costs for an expanded program would be $110,000 with recurring annual costs of $80,000.**

Project 19 - Emphasize partnership efforts in the Conservation Partners Focus Area to restore habitat, place lands under conservation easements from willing participants, enroll land in the USDA Farm Bill conservation programs, or offer land for reforestation under the carbon sequestration initiative.

Waterfowl habitat management is the primary purpose for four refuges. Therefore, efforts will focus on working with partners in the “Conservation Partners” Focus Area to provide migratory bird habitat. This emphasis will ensure that efforts address local, national, and regional plans through future partnerships. **Initial costs are estimated at $110,000 with annual recurring costs of $70,000.**

CULTURAL RESOURCES

Project 20 - Develop the Swan Lake Temple Mound Trail and Interpretive Site at Yazoo NWR.

As required by the Archaeological Resources Protection Act, and others, it is the duty of each land management agency to identify, research, protect, and provide cultural interpretation for the public. To comply with historic preservation laws and regulations, the Swan Lake Temple Mound complex on Yazoo NWR would be developed for public interpretation. A foot path loop trail and footbridges would be constructed from parking areas to the Temple Mound. Interpretive kiosks would be placed at appropriation locations, and a rest/viewing area would be provided. **Initial start-up costs to develop trails, kiosks, and interpretive infrastructure are estimated at $80,000, with a recurring annual cost of approximately $10,000.**

VISITOR SERVICES

Public use activities (Appendix IV, Proposed Public Use Activities) to increase opportunities for wildlife observation, wildlife photography, and environmental education and interpretation will be developed to add to the existing Complex hunting and fishing opportunities. Existing hunting and fishing programs will be enhanced to expand opportunities.

Project 21 - Enhance hunting and fishing programs.

The Complex's hunt program is designed to optimize the number of deer taken while maintaining a percentage of older bucks (5 to 10 percent) in the trophy class, to attract enough hunters to reduce the herd by 33 percent. Hunting is also offered for ducks and other small game, from populations of animals capable of sustaining harvest, including ducks, rabbit, squirrel, raccoon, possum, and quail. Fishing is available on Morgan Brake, Panther Swamp, and Mathews Brake NWRs. Opportunities to offer quality fishing will be pursued and areas designated as open to fishing will be situated to minimize disturbance to migratory birds.

Improvements are planned to accommodate the increasing demand from hunters to purchase permits, gain access to refuge lands, acquire information, comply with hunting regulations, and provide opportunities for physically challenged hunters. The Complex will construct kiosks, hunting blinds, fishing piers, boat ramps, and expand hunting opportunities. **Start-up costs for these hunting and fishing opportunity improvements are estimated at $250,000-300,000 with annual recurring costs of $80,000.**

Project 22 - Construct Bear Paw Self Guided Nature Trail, an extension of the Holt Collier Trail at Yazoo NWR.

This project would enhance the existing Holt Collier Boardwalk Trail and Observation Platform. A trail would be constructed from the existing Holt Collier boardwalk through the forest adjacent to Lizard Lake. Pamphlets with a layout of the trail and identifying information about trees, plants, and other features along the trail would be provided at a kiosk at the trail head. **Initial start-up costs are estimated at $50,000 with a recurring annual cost of $15,000.**

Project 23 - Improve existing roads to develop the Theodore Roosevelt Wildlife Drive, Yazoo NWR.

This project would provide wildlife observation opportunities for those who prefer to see wildlife and natural settings from an air-conditioned or heated vehicle. The Theodore Roosevelt Wildlife Drive, including parking areas, would provide views of Swan Lake's mature bald cypress trees, large alligator populations, and native swamp species. The tour would also include small parking areas and an observation platform in Pryor Lake (formerly Pryor Impoundment) to view wildlife. The tour would then continue past the Cox Ponds for a view of shorebirds, wading birds, and raptors. **Initial start-up costs are estimated at $500,000 with recurring annual costs of $50,000.**

Project 24 - Carbon Sequestration Forest Demonstration Area, Yazoo NWR.

This project would provide visitors with an opportunity to learn how forests function in carbon sequestration and would contain a self-guided trail through trees planted under the carbon sequestration initiative to capture carbon. Several stages of forest succession would be interpreted with informational kiosks at appropriate locations along a self guided trail, and numerous trees would be identified. **Initial start-up costs are estimated at $20,000 with recurring annual costs of $5,000.**

Project 25 - Construct an informational kiosk at Live Oak Mound, Yazoo NWR.

A live oak tree (about 150 years old) grows on a small rounded mound at Yazoo NWR. Archaeological investigations have not revealed any evidence that the mound was constructed by the prehistoric mound-building Native Americans that lived in the region. Live Oak trees are not native to this area, so it is likely that the tree was planted by European settlers. Many visitors have inquired about this interesting sight, and an informational kiosk is planned to provide answers to most frequently asked questions. **Initial start up costs are estimated at $20,000 with recurring annual costs of $2,000.**

Project 26 - Develop the infrastructure for Anhinga Swamp Canoe Trail and Rookery Lookout Platform at Yazoo NWR.

On Yazoo NWR, Swan Lake is an ancient oxbow lake of the Mississippi River that is presently a baldcypress shallow swamp. The portion of the lake bounded on the north by the Yazoo Refuge Road bridge (Long Dump) and on the south by Dike #4 is known as Anhinga Swamp. This area offers extraordinary views of towering bald cypress trees and a rookery supporting numerous species of waterbirds. Planning is underway to develop a canoe trail through the Anhinga Swamp to an observation platform situated to view rookery activities. A boat launch area and parking lot, improved road access, and canoe trails throughout the swamp are planned. Outreach materials to assist visitors would include an interpretive brochure and map and trailhead kiosks. **Initial start-up costs are estimated at $80,000 with recurring annual costs of $8,000.**

Project 27 - Plan and construct Yankee Run, a self-guided Nature Trail at Yazoo NWR.

One refuge in the Complex is named in honor of Holt Collier, a legendary African-American born a slave in 1846 who fought with the Confederate Army against the Union Army. The Yankee Run Nature Trail would be a self-guided trail throughout the forest and swamp, named in honor of one of the legends about Holt Collier. Informational kiosks would be constructed at the trail head, with trail maps and a story of the Holt Collier Yankee tale. **Initial start-up costs are estimated at $30,000 with annual recurring costs of $9,000.**

Project 28 - Construct the Beargarden Lake Trail and Lookout at Yazoo NWR.

To provide visitors with a view of rookery inhabitants and other wildlife in Beargarden Lake (formerly the Cope Impoundment) on Beargarden Road, parking facilities, a footpath, informational kiosk, and an observation platform would be constructed. **Initial start-up costs are estimated at $70,000 with recurring annual costs of $10,000.**

Project 29 - Construct the Alligator Alley Environmental Education Kiosk at Yazoo NWR.

On Yazoo Refuge Road next to the Complex's current Headquarters Office, approximately five adult alligators inhabit a pond constructed for wildlife use. They can often be seen on sunny days, basking on logs or floating motionless in the water. This area is located on the primary road through the refuge and is one of the most popular sights. To enhance the wildlife observation experience and educate visitors about alligators, an environmental education kiosk would be constructed adjacent to the pond. The kiosk would provide information about alligators, their breeding requirements, life span, preferred foods, and other facts. The kiosk would also contain a solar powered audio tape of alligator courtship sounds such as bellowing, slapping their heads on the water, and rumbling. **Initial start-up costs are estimated at $40,000 with recurring annual costs of $5,000.**

Project 30 - Develop Morgan Brake Bluff Trail on Morgan Brake NWR.

The loess bluff habitat on Morgan Brake NWR contains a rare assortment of trees, shrubs, and herbaceous vegetation that does not occur in the Delta. To provide opportunities for visitors to view these unusual plants in a unique geographical setting, a hiking trail will be constructed along the bluff. The trail would include steps and walkways where necessary in areas of steep terrain, and a brochure would be developed to allow for interpretation at several stations along the trail. **Initial start-up costs are estimated at $80,000 with recurring annual costs of $20,000.**

Project 31 - Develop Auto Wildlife Tour on Morgan Brake NWR.

This project would provide wildlife observation opportunities for those who prefer to see wildlife and natural settings from a vehicle. The Commander Brake Wildlife Drive, including parking areas, would provide views of mature bald cypress trees, water birds, alligators, and other native species. The tour would also include a pull-off to allow visitors to access an observation platform on Blockaway Road to view migratory waterfowl and other wildlife. The tour would then continue past the moist-soil units for a view of shorebirds, wading birds, and raptors. **Initial start-up costs are estimated at $250,000 with recurring annual costs of $40,000.**

Project 32 - Develop Panther Creek Wildlife Drive on Panther Swamp NWR.

This project would provide wildlife observation opportunities for those who prefer to see wildlife and natural settings from a vehicle. The Panther Creek Wildlife Drive, including parking areas, would provide views of mature bottomland hardwoods, reforested areas, and wetlands. The tour would also include a small parking area to allow visitors to access an observation platform in the Wood Duck Roost Lake to view waterfowl and other wildlife. The tour would cross Panther Creek where visitors could fish. **Initial start-up costs are estimated at $400,000 with recurring annual costs of $50,000.**

Project 33 - Develop Panther Swamp NWR Observation Tower in Lower Twist.

To provide visitors with a view of waterfowl and other wildlife in a mixed moist soil/agricultural habitat in the Lower Twist area, parking facilities, a footpath, informational kiosk, and an observation platform would be constructed. **Initial start up costs are estimated at $70,000 with recurring annual costs of $10,000.**

Project 34 - Develop observation tower at Morgan Brake NWR.

To provide visitors with a view of moist-soil/shallow-water habitats, shorebirds, waterfowl, and rookery inhabitants, parking facilities, an informational kiosk, and an observation platform would be constructed. **Initial start-up costs are estimated at $50,000 with recurring annual costs of $7,000.**

Project 35 - Improve public access to information by developing and maintaining up-to-date websites for the Complex and each individual refuge. (This project would require the installation of a new satellite system at Morgan Brake and Panther Swamp NWRs to replace the antiquated telephone dial-up system now in use.)

No website currently exists for the Complex and the existing websites for the individual refuges contain a simple Fact Sheet. The Complex can more effectively reach the public and advance environmental education goals with upgraded, interactive web pages. In addition to the narrative, the

web sites would contain several color photos. **Initial start-up costs are estimated at $20,000 with recurring annual costs of $10,000.**

Project 36 - Provide adequate protection for refuge resources, Federal trust species, personnel, and the visiting public.

The Complex hosts more than 100,000 visitors annually for hunting, fishing, and wildlife-dependent recreation. Visitation is expected to increase as public use activities for wildlife observation and photography, and environmental education and interpretation are added or expanded. Additional LE personnel are needed to:

- Protect hunters and other visitors from vandalism, burglary, and assault;
- Ensure that refuge regulations are followed;
- Rescue lost hunters and aid stranded visitors; and
- Protect refuge properties, equipment, cultural and natural resources, and infrastructure.

Four additional LE personnel are needed to provide a minimum level of resource and visitor protection needs. **Initial start-up costs are estimated at $400,000-500,000 with recurring annual costs of $250,000-300,000.**

Project 37 - Employ specialized staff to plan and implement public use activities.

Public use activities planned for refuges in the Complex are dependent upon the availability of personnel with experience and training in public outreach. To introduce new public use activities and expand existing activities, Park Rangers (Interpretive), Maintenance Staff, Law Enforcement personnel, and a Complex Outdoor Recreation Planner are needed. Efforts will also target the establishment of a Friends group and volunteer recruitment program to conduct public use activities, interact with visitors, develop and maintain public use facilities, and greet and orient visitors. FTE's to accomplish these activities are outlined in "Administration" below.

ADMINISTRATION

This draft plan outlines proposed projects that would exceed budget allocations. Therefore, CCP implementation will require increased funding and personnel from internal and external sources. New projects are identified in RONS, while maintenance needs for existing facilities and projects are identified through MMS.

Project 38 - Increase FTE's from 19 to 61.5 to manage refuge lands, conduct research and monitoring, manage refuge personnel, and plan and implement public use activities.

Implementing the vision set forth in this CCP will require changes in the organizational structure of the Complex and each of the refuges. The organizational tables identify additional positions and the intended structure of the Complex.

Project 39 - Construct a Visitor's Center and Headquarters Facility for TR NWR Complex.

An immediate need exists to construct a new facility at Yazoo NWR to function as a Headquarters Office for the Complex where personnel would meet and greet the public and provide for their wildlife dependent recreation and other requests. The current Headquarters Office is 46 years old (constructed in 1958) and is functionally outdated. The Headquarters Office provides only one

restroom for both male and female employees, and the sink in the bathroom provides the only running water in the office. The bathroom is not ADA accessible due to narrow doorways and cramped space inside the bathroom. The heating system is a propane-gas-based furnace that is outdated. The building lacks storage for basic office needs. Because the front door of the office is located on the back of the building, facing away from the highway, the office does not provide a favorable appearance to the visiting public. The new facility would be located at the intersection of Beargarden Road and Yazoo Refuge Road, and would contain an educational visitor resources center with reception area, display room, public restrooms, employee restrooms, conference center, songbird viewing and feeding atrium, office space, educational auditorium, and other resources to enhance public use of the refuges in TR NWR Complex. **Initial start-up costs are estimated at $3 M with recurring annual costs of $50,000.**

Project 40 – Meet current and expand the ability to meet growing maintenance needs.

With over 90,000 acres of refuge lands scattered throughout central Mississippi, the maintenance staff is challenged to adequately provide for existing needs. To adequately maintain existing needs and develop future infrastructure for public use activities and habitat management, and to comply with SAMMS Database requirements, additional staff, equipment, office space, and funding is needed. Additional funding and personnel would be used to construct new roads and trails, maintain existing roads and trails, develop and maintain observation platforms, maintain water control structures, levees and refuge facilities, maintain equipment and vehicles, input and manage information in SAMMS, and other refuge maintenance needs. **In addition to personnel costs annual maintenance needs are estimated at $250,000 annually.**

Project 41 - Improve fire suppression and prescribed burning capabilities.

Provide necessary training and equipment to personnel involved in fire suppression and presuppression activities. Provide personnel to address wildfires and prescribed burn activities on the Complex. Conduct prescribed burn treatments for habitat management and enhancement. **Annual costs are estimated at $15,000.**

FUNDING AND PERSONNEL

Implementation of this plan will require increased funding and personnel support that will come from a variety of internal and external sources. New projects are identified in RONS, while maintenance needs for existing facilities and projects are identified through MMS. This draft plan outlines proposed projects that are substantially above current budget allocations. The plan does not constitute a commitment (from Congress) for staffing increases, operational and maintenance increases, or funding for future land acquisition, but represents wildlife resource needs based on sound biological science and input from the public.

According to predictions based on the RONS database, the refuge staff will need to increase from a total of 19 in Fiscal year 2004 to a total of 31 by 2011 (Table 17). This increase in staff will also necessitate an increase in base funding above standard yearly increases that allow only for inflation.

Implementing the vision set forth in this CCP will require changes in the organizational structure of the Complex and each of the refuges. Existing staff will direct their time and energy in new directions and new staff members will be added to assist these efforts. The following tables and organizational chart identify the additional positions and future structure of the Complex.

Table 17. Theodore Roosevelt NWR Complex Proposed Staffing Chart.
Existing staff are depicted with a "*"

Theodore Roosevelt NWR Complex ***Refuge Complex Manager (GS-14)** ***Deputy Project Leader (GS-13)**		
Hillside National Wildlife Refuge Refuge Operations Specialist (GS-9) Wildlife Biologist (GS-9) Park Ranger (LE), GS-7 Outdoor Rec Specialist (GS-9) *Biological Technician (GS-7) Biological Technician (GS-7) Biological Technician (GS-5) *Equipment Operator (WG-8), currently not funded	**Complex Headquarters** *Complex Forester (GS-11, Upgrade To 12) Forestry Tech (GS-7) *Administrative Officer (GS-9) *Office Clerk (GS5) Secy/Receptionist (GS-5) *Complex Wildlife Biologist (GS-11/12) Outdoor Recreational Planner (GS-11/12) *Lead Park Ranger (Le), (GS-9) GIS/It Specialist (GS-9/11) Refuge Planner (GS-11/12) *Private Lands Biologist (GS-11) ROS (Safety/Samms) (GS-9) Park Ranger (Interpretive), (GS-7	**Panther Swamp NWR** *Refuge Manager (GS-11, upgrade to GS-12) Office Clerk (GS-5) Office Clerk, seasonal, (GS-5) Refuge Operations Specialist (GS-9) Refuge Operations Specialist (GS-7) Forester (GS-11) Wildlife Biologist (GS-9) *Biological Technician, (GS-7) Park Ranger (LE), GS-7 Park Ranger (LE), seasonal GS-7 Biological Technician (GS-7), farming Biological Technician (GS-5) *Equipment Operator (WG-10) Maintenance Worker (WG-7) Equipment Operator (WG-8)
Yazoo National Wildlife Refuge (2) Refuge Operations Specialists (GS-11/12) Outdoor Rec Planner (GS-9) Wildlife Biologist (GS-9) (2) Park Ranger (LE) (GS-7) Seasonal Park Ranger (LE) (GS-5/7) FT Biological Technician (GS-7 Maintenance Worker (WG-6) *Automotive Worker (WG-8) *2 Equipment Operators (WG-8) Forester (GS-9)	**Morgan Brake National Wildlife Refuge** *Refuge Manager (GS-11, upgrade to GS-12) (2) Refuge Operations Specialists (GS-9) Park Ranger (Interpretive) (GS-7/9) Park Ranger (LE) GS-9 Secy/Receptionist (GS-5) *Biological Technician (GS-7) (2) Biological Technician (GS-7) Equipment Operator (WG-8)	**Mathews Brake National Wildlife Refuge** Refuge Operations Specialist (GS-9) Biological Technician (GS-7) Park Ranger (LE) (GS-5/7) Seasonal

STEP DOWN MANAGEMENT PLANS

A comprehensive conservation plan is a strategic plan that guides the management direction of the Complex. Implementation of this plan will require strategies detailed in step-down management plans. Current refuge plans need to be updated. New plans will be developed as needed (Table 18).

PARTNERSHIP OPPORTUNITIES

A major objective of this comprehensive conservation plan is to establish partnerships with local volunteers, landowners, private organizations and state and federal natural resource agencies. In the immediate vicinity of the refuge, opportunities exist to establish partnerships with sporting clubs, elementary and secondary schools, and community organizations. At regional and state levels, partnerships might be established with organizations such as the Mississippi Department of Wildlife, Fisheries, and Parks, Ducks Unlimited, The Nature Conservancy, Audubon Society, National Wild Turkey Federation, and Mississippi Wildlife Federation, Wildlife Mississippi, and Delta Wildlife.

The refuge volunteer program and other partnerships generated will depend upon the number of staff positions the Service provides the refuge. As staff and resources are committed to the refuge, opportunities to expand the volunteer program and develop partnerships will be enhanced.

MONITORING AND EVALUATION

Adaptive management is a flexible approach to long-term management of biotic resources that is directed over time by the results of ongoing monitoring activities and other information. More specifically, adaptive management is a process by which projects are implemented within a framework of scientifically driven experiments to test the predictions and assumptions outlined within a plan.

To apply adaptive management, specific survey, inventory, and monitoring protocols will be adopted for the Complex. The habitat management strategies will be systematically evaluated to determine management effects on wildlife populations. This information will be used to refine approaches and determine how effectively the objectives are being accomplished. Evaluations will include LMVJV, ecosystem team, and other appropriate partner participation. If monitoring and evaluation indicate undesirable effects for target and non-target species and/or communities, then alterations to the management projects will be made. Subsequently, the CCP will be revised.

Specific monitoring and evaluation activities will be described in the step-down management plans.

Table 18. Proposed schedule for Step-down Management Plans.

Plan	Date Completed/ Updated	Update/Develop By
Endangered Species		2007
Wildlife Management Plans		
Waterfowl		2009
Shorebird & Water Bird		2009
Neo-tropical migrant/Birds of concern	1992	2009
Resident Game Species		2009
Non-game Species		2006
Fisheries	1989	2009
Wildlife Inventory	1985	2005
Integrated Pest Management Plans	1997	2006
Invasive Species Management Plan		2006
Habitat Management Plans		
Moist Soil/Water		2009
Forest Habitat	1995	2006
Grassland		2005
Cropland		2009
Fire Management	2001	2006
Visitor Services Plans		
Hunting and Trapping	1991	2006
Fishing	1992	2007
Wildlife Observation, Environmental Education & Interpretation, Photography	2001	2007
All Terrain Vehicle Use	1986	2005
Sign	1985	2005
Law Enforcement	2001	2005
All Terrain Vehicle Use	1986	2005

PLAN REVIEW AND REVISION

This CCP will be reviewed annually to determine the need for revision. A revision would occur if and when significant information becomes available, such as a change in ecological conditions or a major Complex expansion. The final plan would be augmented by detailed step-down management plans to address the completion of specific strategies in support of the refuge's goals and objectives. Revisions to the CCP and the step-down management plans would be subject to public review and NEPA compliance.

I. Background

PURPOSE AND NEED FOR ACTION

The purpose of the proposed action is to specify a management direction for the Theodore Roosevelt National Wildlife Refuge Complex for the next 15 years. This management direction will be described in detail through a vision statement and a set of Complex-wide goals, objectives, and strategies in the Comprehensive Conservation Plan.

The action is needed because adequate, long-term management direction does not exist for the Complex. Management is currently guided by a series of general policies and step-down plans that are in need of revision based on new laws, policies, and the mission of the National Wildlife Refuge System. Also, the action is needed to address current management issues and to satisfy the legislative mandates of the National Wildlife Refuge System Improvement Act of 1997, which requires the preparation of a comprehensive conservation plan for all national wildlife refuges by 2012.

The purpose of each refuge in the Complex was established by Congress. While several of the refuges having overlapping purposes, each refuge was established individually and added to the Complex. Table 2 in Section A summarizes the establishing dates and authorities of each refuge.

The Complex includes Yazoo (established in 1936), Hillside (1975), Morgan Brake (1977), Panther Swamp (1978), and Mathews Brake (1980) National Wildlife Refuges.

While the draft CCP was being prepared, the Complex was known as the Central Mississippi Refuge Complex. However, on January 23, 2004, the Theodore Roosevelt National Wildlife Refuge Act (Section 145 of PL 108-199 - the Consolidated Appropriations Act of 2004) was signed into law by President Bush. This legislation changed the Complex name to the Theodore Roosevelt National Wildlife Refuge Complex, designated the Bogue Phalia Unit of Yazoo NWR as the Holt Collier NWR, and directed the Secretary of the Interior to establish a new refuge of 6,600 acres within the Complex. This new refuge will be known as the Theodore Roosevelt NWR.

This Environmental Assessment was prepared and a list of issues was developed using guidelines of the National Environmental Policy Act of 1969. The Act requires the Fish and Wildlife Service to examine the effects of proposed actions on the natural and human environment. This analysis assists the Service in determining if it will need to prepare an environmental impact statement or a Finding of No Significant Impact for the comprehensive conservation plan. In the following sections, four alternatives are described for future refuge management, the environmental consequences of each alternative, and the Service's preferred management direction. Each alternative was designed as a reasonable mix of fish and wildlife habitat options and wildlife-dependent recreational opportunities. The preferred alternative was selected based on the environmental consequences, the ability to achieve the Complex purposes, and the ability to achieve identified goals. These goals, listed below, were developed by the refuge staff and planning team and encompass all aspects of Complex management including public use, habitat management, and maintenance operations.

*MIGRATORY BIRDS***.** To provide for resting, feeding, and breeding needs of the greatest variety of waterfowl species using the LMRAV, the Complex will manage a complex of habitats: croplands, moist-soil impoundments, and bottomland hardwood forests (including greentree reservoirs)

OTHER FISH AND WILDLIFE. Implement a program of science-based stewardship of the fish and wildlife resources associated with the Theodore Roosevelt National Wildlife Refuge Complex.

*THREATENED AND ENDANGERED SPECIES***.** Support the implementation of national and regional threatened and endangered species recovery plans.

HABITAT MANAGEMENT. Maintain and/or restore, if appropriate, natural ecological communities to promote a healthy, functioning Lower Mississippi River Ecosystem while meeting the objectives of national and regional plans.

*LAND PROTECTION AND CONSERVATION***.** Enhance the integrity of the lands within the authorized boundary of the Complex and contribute to the protection and restoration of fish, wildlife, and cultural resources found within the Yazoo Backwater Area and the Lower Mississippi River Alluvial Valley.

CULTURAL RESOURCES. Identify and protect refuge cultural resources on the Complex in accordance with federal and state historic preservation legislation and regulations.

VISITOR SERVICES. Increase the public understanding, use, and enjoyment of the natural and cultural resources of the Theodore Roosevelt National Wildlife Refuge Complex, the National Wildlife Refuge System, and the Fish and Wildlife Service, consistent with the principles of "Wildlife First."

ADMINISTRATION. Provide administrative support and facilities needed to ensure that the goals and objectives identified in the comprehensive conservation plan can be achieved.

DECISIONS TO BE MADE

DECISION FRAMEWORK. The Fish and Wildlife Service will make two decisions based on this environmental assessment: (1) select an alternative and (2) determine if the selected alternative is a major federal action significantly affecting the quality of the human environment, thus requiring preparation of an environmental impact statement. The planning team has recommended Alternative B as the alternative to guide the management direction of the refuge. The recommendation was based on evaluation of the purposes for which each refuge was established, the mission of the Service and the National Wildlife Refuge System, and other legal mandates and pertinent plans. The draft comprehensive conservation plan was developed for implementation based on this recommendation. Assuming that no significant impacts are found, implementation of the plan will begin, and the plan will be monitored on an annual basis and revised when necessary, typically every 5 years. This plan will guide the Complex for the next 15 years and serve as the foundation for all future planning efforts.

PLANNING STUDY AREA. The planning study area for this environmental assessment includes the current refuge acquisition boundaries. The Fish and Wildlife Service currently owns and manages 77,009 acres (68 percent) of the 113,060 acres lying within the Complex 5 refuge acquisition boundaries. The Service will seek to acquire, from willing sellers, the remaining 36,051 acres. In addition, the refuge owns 12,451 acres in 32 Farm Service Agency properties.

The Agricultural Credit Act of 1987 authorized the FmHA, now known as the Farm Service Agency, to transfer fee title interest in inventory farm property, without reimbursement, to Federal or State agencies for conservation purposes. During the late 1980s and early 1990s several thousands of acres of lands having high potential fish and wildlife value were transferred to the Service, primarily in the southeastern United States. These tracts range in size from a few acres to several thousand acres and pose management problems for the Service due to several reasons, including distance from existing stations, lack of manpower and funding to manage and patrol, and trespass issues.

For the most part, the Farm Service Agency properties are assigned to the nearest refuge station and managed with the other refuge lands based on their habitat types and size. This environmental assessment will identify management on refuge lands as well as those lands within the approved acquisition boundary that have yet to be acquired by the Service.

AUTHORITY, LEGAL COMPLIANCE, AND COMPATIBILITY. The National Wildlife Refuge System includes federal lands managed primarily to provide habitat for a diversity of fish, wildlife, and plant species. National wildlife refuges are established under many different authorities and funding sources for a variety of purposes. The purposes for each refuge were established by specific legislation and are listed in the previous section. Additional authority delegated by Congress, federal regulations, executive orders, and several management plans guide the operation of the Complex. Appendix III contains a complete list of the key laws, orders, and regulations that provide a framework for the proposed action.

- Lands within the National Wildlife Refuge System are closed to public uses unless specifically and legally opened. All programs and uses must be evaluated based on mandates set forth in the National Wildlife Refuge Improvement Act of 1997. Those mandates are:
- Contribute to ecosystem goals as well as refuge purposes and goals;
- Conserve, manage, and restore fish, wildlife, and plant resources and their habitats;
- Monitor the trends of fish, wildlife, and plants;
- Manage and ensure appropriate visitor uses as those uses benefitting the conservation of fish and wildlife resources and contribute to the enjoyment of the public; these uses include hunting, fishing, wildlife observation, wildlife photography, environmental education, and interpretation; and
- Ensure that visitor activities are appropriate and compatible with refuge purposes.

ISSUES AND CONCERNS

Initial planning meetings began in August 2000. A planning team was established, issues were identified, and an initial mailing list was developed. In addition, the Mississippi Department of Wildlife, Fisheries and Parks and the Tunica and Quapaw tribes were invited to participate in all aspects of planning. Preparation began for biological and public use reviews that would provide a team recommendation for the future management and direction of these refuges. Three biological reviews and two public use reviews were completed during the winter. Public outreach began in the spring through public meetings, mailings, news releases, interviews with the media, and written articles. Announcements giving the location, date, and time for the public meetings were sent to everyone on the mailing list, as well as to local newspapers and radio and television stations. Posters announcing the meetings were also used. Input obtained from all of these meetings and correspondence was considered in developing the draft comprehensive conservation plan. Chapter III of the plan contains a more detailed description on the scoping of issues.

An array of issues, concerns, and opportunities was addressed during the planning process. Numerous discussions among citizens, focus groups, resource specialists, and refuge planning staff brought to light several recurring themes. In general, themes centered on creating a balanced public use program; migratory bird management; water quality including watershed activities; pest and invasive species management; hunting and fishing programs; restoring interior forest habitat; and lack of staff and facilities. Some of the issues raised during internal and public scoping included:

- Controlling exotic/invasive species;
- Providing a quality hunting experience, including disabled and youth hunting opportunities;
- Providing adequate LE.
- Using all-terrain vehicles for wildlife-dependent recreation;
- Expanding hunting and fishing opportunities;
- Providing wildlife observation and photography opportunities
- Developing a balanced wildlife-dependent recreation program;
- Controlling sedimentation and contamination affecting refuge lands;
- Controlling beavers to protect bottomland hardwoods;
- Managing reforested lands;
- Providing habitat for upland game birds;
- Managing croplands for waterfowl;
- Managing water levels and moist soil for waterfowl and shorebirds;
- Providing technical assistance to private landowners;
- Expanding the current refuge acquisition boundaries; and
- Researching bottomland hardwoods.

Further discussion of these issues and concerns can be found in Chapter III of the draft plan.

II. Alternatives

FORMULATION OF ALTERNATIVES

Alternatives are different approaches or combinations of management objectives and strategies designed to achieve the refuge purpose, vision, and the goals identified for the comprehensive conservation plan; the priorities and goals of the Lower Mississippi Valley Ecosystem Team; the goals of the National Wildlife Refuge System; and the mission of the Fish and Wildlife Service. Four management alternatives were developed by the planning team based on issues, concerns, and opportunities presented during the scoping process. The issues that are discussed came from individuals, cooperating agencies, conservation organizations, and refuge staff. A summary of the alternatives is provided in Table 19. Although many alternatives were presented for discussion by individuals, the alternatives that were evaluated in detail were those that would support the aforementioned vision, purposes, goals, and mission. Each alternative is designed with the capability to be fully developed in a CCP.

Specific impacts of implementing each alternative are examined in eight broad issue categories as listed.

MIGRATORY BIRDS. How will the complex of habitats needed to maintain the current diversity of bird species, while providing for other more imperiled migratory birds, be provided? How will the habitat objectives identified in support of national and regional plans be met? How will population responses to habitat programs be monitored?

OTHER FISH, WILDLIFE, AND PLANTS. How will the critical habitat needs of wildlife that depend on the Complex resources be met? Will the proposed management scenario benefit natural biodiversity? How will the needs of migratory bird species utilizing the Complex be met?

HABITATS. What level of habitat restoration and maintenance is appropriate given desired future conditions? What diversity and quantity of habitats are needed to meet objectives in support of national and regional plans?

VISITOR SERVICES AND RECREATION. What is the appropriate level of recreational activities on the Complex? Does the Complex adequately meet the mandate to provide quality wildlife-dependent recreation? How can a more balanced program accommodating all six priority public uses be created? How can all visitors be made aware of the purposes and mission of the Complex and the National Wildlife Refuge System?

*RESOURCE THREATS***.** What aspects of surrounding land uses threaten the integrity of ecological processes on the Complex? What can the Complex do to control or reduce negative impacts?

LAND PROTECTION. Can the Complex play a larger role in resource conservation in the Lower Mississippi River Ecosystem?

REFUGE ADMINISTRATION. What level of staffing, funding, and facilities will be needed to meet the objectives?

OTHER HUMAN DIMENSIONS. What will be the gains or loses to local communities by implementing proposed management programs?

DESCRIPTION OF ALTERNATIVES

ALTERNATIVE A – CURRENT MANAGEMENT (NO ACTION)

Existing Complex management and public outreach practices would be favored under this alternative. All refuge management actions would be directed towards achieving the Complex's primary purposes, including: (1) preserving wintering waterfowl habitat; (2) providing production habitat for wood ducks; and (3) meeting the habitat conservation goals of the North American Waterfowl Management Plan, all the while contributing to other national, regional, and state goals to protect and restore shorebird, neotropical breeding bird, woodcock, and threatened and endangered species. Refuge management programs would continue to be developed and implemented with little baseline biological information. Active habitat management would be implemented through water level manipulations, moist-soil and cropland management, and reforestation designed to provide a diverse complex of habitats that meet the foraging, resting, and breeding requirements for a variety of species. Complex staff would continue to restore and maintain existing wetlands, open waters, grasslands, and bottomland hardwood forest habitats. Land would be acquired from willing sellers within the current acquisition boundaries totaling 113,060 acres.

Hunting and fishing would continue to be the major focuses of the Complex public use program, with no expansion of current opportunities. Current restrictions or prohibitions would remain. All-terrain vehicle use would continue at its current level, with little maintenance to existing trails. Environmental education and wildlife observation and photography would be accommodated on a case-by-case basis. Plans would continue to include funding requests to construct a Complex headquarters office/visitor contact area on Yazoo National Wildlife Refuge and continue the rehabilitation of other existing facilities.

Chapter II of the draft comprehensive conservation plan contains more details about the current situation.

ALTERNATIVE B - BALANCED HABITAT AND PUBLIC USE EMPHASIS (PREFERRED ALTERNATIVE)

The Service planning team has identified Alternative B as the preferred alternative. This alternative was developed based on public input and the best professional judgment of the planning team. The strategies presented in the draft comprehensive conservation plan were developed as a direct result of the selection of Alternative B. This alternative is described in greater detail in Chapter IV of the draft comprehensive conservation plan.

This alternative would promote a greater understanding of, and protection for, the fish, wildlife, and their habitats and a higher quality and more evenly balanced recreational and educational program for visitors. Current hunting and fishing programs would continue with greater emphasis on the quality of the experience with more diverse opportunities, including those for youth and disabled hunters/anglers. Education and interpretation would be promoted through regular programs and partnerships with local schools. Wildlife observation and photography opportunities would be expanded, including trails, auto tours, photo blinds, and observation towers, highlighting refuge management programs and unique wildlife and habitats. All-terrain vehicle use for wildlife-dependent recreation (e.g., hunting and fishing) would continue to provide access to remote portions of certain refuges. Trails to accommodate these vehicles would be evaluated for retention based on impacts to refuge resources, access, duplication, and other means of access. If possible, trails removed for these reasons would be rerouted if needed for hunter dispersal. A user fee and permit would be

required for all-terrain vehicles to provide additional funds needed for the costly trail maintenance program.

A visitor center and headquarters office would be constructed at Yazoo National Wildlife Refuge. Two new subheadquarters and visitor contact stations would be constructed at Panther Swamp NWR and Morgan Brake NWR refuges. The new subheadquarters at Panther Swamp refuge would be located off Highway 49 or River Road, to provide greater visibility and access to the public.

Reforestation efforts would focus on creating buffers along field edges to protect waterfowl and other waterbirds from disturbance, and define boundaries along adjacent private lands. As lands are acquired, they would be evaluated for their ability to contribute to step-down habitat objectives (e.g., moist soil) and to interior forest habitat.

Research studies on bottomland hardwood restorations would be fostered and partnerships developed with universities and other agencies, providing needed resources and experiment sites, while meeting the needs of the Complex's reforestation programs. Research would also benefit efforts throughout the LMRAV to reforest large tracts of lands to meet the objectives set by the Lower Mississippi Joint Venture office to address the fulfillment of the Partners-in-Flight Plan.

Additional staff and facilities would be added to accomplish objectives for establishing baseline data on refuge resources, managing habitats, providing opportunities and facilities for wildlife observation and photography, and providing educational programs that promote a greater understanding of the Complex purposes, issues, and resources and the unique values of the LMRAV.

Under this alternative, 125,511 acres of refuge lands (including refuges and Farm Service Agency properties) would be protected, maintained, restored, and enhanced for resident wildlife, waterfowl, migratory nongame birds, and threatened and endangered species. A "Conservation Partners" Focus Area would be established to not only concentrate off-refuge resources, but for partnership opportunities and future boundary expansion studies to meet regional and national objectives. Extensive wildlife and plant censuses and inventory activities would be initiated to obtain the biological information needed to implement and monitor management programs on the Complex. All refuge management actions would be directed towards achieving each refuge's primary purposes, while contributing to other national, regional, and state goals. Active habitat management programs would include water level manipulations, moist-soil and cropland management, reforestation, and existing forest management designed to provide a diverse complex of habitats that meet the foraging, resting, and breeding requirements for a variety of species, particularly migratory birds. An extensive system of levees, water control structures, and wells would be maintained and developed in an effort to mimic historic flooding regimes.

As funding becomes available to either contract or conduct farming operations with Complex equipment and staff, acres in agricultural production would be reduced by at least half, depending upon the level of funding and yield. The majority of the acres would be converted to moist soil to meet habitat objectives and needs of wintering waterfowl and other waterbirds, and scrub/shrub and grassland habitats for neotropical migratory birds, woodcock, and upland game birds. Additional lands would be reforested, but due to the size and distribution of sites, would not be sufficient to meet any interior forest objectives. An assortment of step-down management plans would be created or updated to provide the specifics for the individual refuge programs.

Under this alternative, the refuge would continue to seek acquisition of all willing-seller inholdings within the present acquisition boundary. Top priority would be lands which, if acquired, would address some critical issues related to habitat protection, access, and off-refuge impacts. Lands acquired as part of the refuge would be made available for compatible wildlife-dependent public recreation and environmental education opportunities. Equally important options to be used include: Corps of Engineers' mitigation program, outreach and partnerships with adjacent landowners, hunt clubs, and the Natural Resources Conservation Service to use conservation easements, cooperative agreements, and federal programs, such as the Wetland Reserve Program, to link bottomland hardwood forest tracts and contribute to overall wildlife, soil, and water conservation benefits within the LMRAV.

ALTERNATIVE C - PUBLIC USE EMPHASIS

This approach would de-emphasize managing habitats while allowing for more public recreational uses (e.g., hunting and fishing), with added emphasis on environmental education, interpretation, wildlife observation, and wildlife photography. Any additional staff, emphasis, and resources would be directed to allow for more compatible public activities in all areas of the Complex. Additional moist soil, scrub/shrub, forested lands, and grasslands would not be restored and managed. Moist-soil impoundments, currently managed for waterfowl and shorebirds, would be converted to fishing ponds for public use. Hunting seasons would be aligned with state regulations to allow for maximum use. All-terrain vehicle use would continue to disperse hunters. Additional funding would be needed to maintain the maximum number of trails and roads for access.

Auto tours, canoe trails, foot trails, and observation towers would be added for environmental education and watchable wildlife programs. Additional staff would be used for developing and presenting both on- and off-site outreach and interpretation programs.

A visitor center and headquarters office would be constructed at Yazoo NWR refuge. Two new subheadquarters and visitor contact stations would be constructed at Panther Swamp and Morgan Brake refuges. The new subheadquarters at Panther Swamp refuge would be relocated off Highway 49 or River Road to provide greater visibility and access to the public.

Land acquisition within the current acquisition boundary would continue with emphasis on those lands that can provide additional public use opportunities and greater access to current refuge lands by the public.

ALTERNATIVE D - INTERIOR FOREST HABITAT EMPHASIS

Under this alternative, all suitable refuge lands would be reforested in support of migratory birds and other wildlife dependent on interior forest habitats. Most refuge management actions would be directed towards creating and managing the largest amount of interior and corridor forest habitat (for Louisiana black bear, neotropical migratory songbirds, and other interior forest wildlife), and reducing forest fragmentation while supporting the overall primary purpose for the Complex of preserving wintering habitat for mallards, pintails, and wood ducks; and providing production habitat for wood ducks and other migratory birds dependent on forested habitats. Other national, regional, and state goals to protect and restore shorebird, grassland, and scrub- shrub bird populations would be supported secondarily in habitats that were not suitable for reforestation. Step-down waterfowl objectives for unharvested crops and moist soil, established by the Lower Mississippi Joint Venture in support of the North American Waterfowl Management Plan, would not be met. However, wintering waterfowl would potentially benefit from additional flooded timber habitat, including mast and invertebrate production.

Open habitat for geese would not be maintained on Yazoo NWR and farming would be eliminated throughout the Complex. Eliminating farming would eliminate goose use, maximize the amount of forests and forested corridor habitats, and minimize forest fragmentation. A forest management plan, designed to address this alternative's primary goals by creating spatially and specifically diverse woodlands, would be developed and implemented.

High quality wildlife-dependent recreation activities (e.g., hunting, fishing, wildlife observation, and environmental education and interpretation) would be provided. An environmental education plan, incorporating aggressive and proactive promotion of on- and off-site programs, would be developed and implemented. Improvements would be made to interior and exterior roads to provide all-weather vehicular access to a broad segment of the public; however, existing and proposed roads and trails would be evaluated for their impacts on forest fragmentation. Wildlife observation sites/platforms, interpretive trails, boardwalks, kiosks, and restrooms would be provided at specific sites to allow for fully accessible interpretation and environmental education programs. Current hunting and fishing programs would be maintained with fishing occurring on Panther Swamp, Hillside, Morgan Brake, and Mathews Brake NWRs.

Under this alternative, the Complex would continue to seek acquisition of all willing-seller inholdings within the present acquisition boundary. Highest priority would be given to those lands that may be reforested to contribute to the interior forest objectives. Lands would be made available for compatible wildlife-dependent public recreation and environmental education opportunities. Additionally, the Complex would concentrate on all future off-refuge programs and partnerships within the "Conservation Partners" Focus Area, with an emphasis on contributing to interior forest habitat.

COMPARISON OF ALTERNATIVES

Each alternative, if implemented, would accomplish the Complex's vision to varying degrees while addressing the issues and concerns identified by the planning and scoping teams and the general public. However, each does so in different ways.

Table 19. Summary of management alternatives for the Theodore Roosevelt National Wildlife Refuge Complex

Issues	Alternative A (Current Management)	Alternative B (Preferred Alternative)	Alternative C (Public Use Emphasis)	Alternative D (Interior Forest Emphasis)
Migratory Birds				
Waterfowl	Complex of habitats; does not meet LMVJV step-down objectives. Surveys not standardized.	Meet/exceed the LMVJV habitat objectives. Surveys standardized.	No Active Management	Does not meet LMVJV step-down objectives for unharvested crops and moist soil. No long-term management for woodcock and other early successional dependent wildlife.
Shorebirds	Primary management on Cox Ponds at Yazoo.	Expand moist-soil habitats managed for shorebirds to a minimum of 300 acres.	No Active Management	Same as Alternative A
Waterbirds	No Active Management	Moist-soil impoundments managed for marsh birds and rookeries identified and protected	Same as Alternative A	Same as Alternative A
Songbirds	No Active Management	Conduct point counts and transect surveys. Create a complex of interior forest, scrub/shrub, and grassland habitats.	Same as Alternative A	Same as Alternative B, except all available lands would be reforested on each refuge creating habitat only for interior forest-dependent species.

Issues	Alternative A (Current Management)	Alternative B (Preferred Alternative)	Alternative C (Public Use Emphasis)	Alternative D (Interior Forest Emphasis)
Raptors	No Active Management	Conduct baseline survey. Provide foraging habitat along roadsides, create scrub/shrub and grassland habitats.	Same as Alternative A	Raptors dependent on interior forest lands supported.
Woodcock	No Active Management	Early successional habitat maintained.	Same as Alternative A	Initial habitat provided in reforested habitat, but not maintained.
Habitats				
Moist Soil	Active management focused on Cox Ponds at Yazoo.	Current potential for moist-soil habitat maximized throughout the Complex and additional acres identified and restored to meet LMVJV objectives.	No active management	Same as alternative A
Bottomland hardwood Forest	Continue implementing Panther Swamp Forest Management Plan.	Manage existing and reforested lands to provide the maximum structural diversity.	No active management	Same as Alternative B, except restore and manage the maximum acres of bottomland hardwood forests to the exclusion of other habitats and step down objectives.

Issues	Alternative A (Current Management)	Alternative B (Preferred Alternative)	Alternative C (Public Use Emphasis)	Alternative D (Interior Forest Emphasis)
Interior forest	Maintain 20,000-acre interior forest habitat at Panther Swamp.	Expand Alternative A. Seek opportunities through partnership to link fragmented forest habitats to create blocks of interior forest habitat (>10,000 acres).	Same as Alternative A	Expand Alternative A. Seek opportunities through partnership to link fragmented forest habitats to create blocks of interior forest habitats (>10,000 acres). Reforest lands within all refuge acquisition boundaries to expand or create interior forest habitats.
Loess bluffs	Protect portions of loess bluff habitat within the current acquisition boundary.	Same as Alternative A, except expand boundaries on Hillside and Morgan, no more than 10 percent, to protect additional bluff habitat from development.	Same as Alternative A	Same as Alternative B
Scrub/shrub	Scrub/shrub habitat would be available in early successional reforested lands, but would not be maintained.	Same as Alternative A, except a portion of the acres not needed for cropland production would be maintained in scrub/shrub habitat through disking, chemical use, selective harvest, and other means.	No active management	Same as alternative A.

Issues	Alternative A (Current Management)	Alternative B (Preferred Alternative)	Alternative C (Public Use Emphasis)	Alternative D (Interior Forest Emphasis)
Grasslands	No Active management	A portion of the acres not needed for cropland production would be maintained in grassland habitat by disking, burning, planting, and chemical use.	Grassland habitat would be managed to provide for upland bird hunting.	Same as alternative A
Croplands for waterfowl	9,600 acres would be cooperatively farmed.	4,000 to 5,000 acres would be farmed using Complex resources or contract-farmed to meet step-down objectives for waterfowl.	Same as Alternative A	All suitable farmland would be reforested.
Open water	Current acres maintained	Same as alternative A, except provide additional open-water habitat to increase fishing opportunities.	Maximize creation of open-water habitats throughout the Complex to provide additional recreational uses.	Same as Alternative A
Other Fish, Wildlife, and Plants				
Invasive species	Control known invasive species incidental to other programs.	Develop a comprehensive invasive species program and plan that aims to inventory and eradicate invasives.	Only invasive species impacting recreational wildlife species would be controlled.	Same as Alternative B

Issues	Alternative A (Current Management)	Alternative B (Preferred Alternative)	Alternative C (Public Use Emphasis)	Alternative D (Interior Forest Emphasis)
Pest management	Control known pest species incidental to other programs	Develop a comprehensive and integrated pest management program to inventory and control damage to habitats and other fish and wildlife.	No active management	Same as Alternative B
Threatened and endangered (T&E) species (Federal)	Incidental monitoring and documenting of T&E species.	Inventory and support recovery plans for T&E species that do or may occur on the Complex.	No active management	Same as Alternative B, except support recovery plans that only address interior forest-dependent wildlife species.
White-tailed deer	Concentrated effort to manage population and provide a quality hunting program.	Increase efforts on analyzing impacts of population on habitats and monitor sudden population declines, while using a quality hunting program to reduce impacts to resources.	Same as Alternative A	Same as Alternative B
Upland game birds	Populations are benefited by current management programs for migratory birds.	Added emphasis on maintaining early successional habitats (e.g., grasslands, scrub/shrub), will benefit these species.	Early successional habitats and food plots will be planted to benefit upland game birds to maximize hunting opportunities.	Populations will benefit at various stages of restoration of interior forest, but will not be maintained.

Issues	Alternative A (Current Management)	Alternative B (Preferred Alternative)	Alternative C (Public Use Emphasis)	Alternative D (Interior Forest Emphasis)
Amphibians & reptiles	No active management; only rudimentary surveys.	A comprehensive survey will be implemented and critical breeding habitats identified.	No active management	Same as Alternative B
Fisheries	Maintain current deep-water habitat throughout the Complex, incidentally monitoring bioaccumulated contaminant levels in fish.	Expand Alternative A. Additional deep-water habitats will be created at Carter, Morgan Brake, and Yazoo to provide fish habitat.	Expand Alternative A. Additional deep-water habitats will be created at Carter, Morgan Brake, and Yazoo to provide fish habitat. Additional acres, currently used for moist-soil impoundments, will be converted to perpetual deep-water habitats.	Same as Alternative A
Visitor Services and Recreation				
Hunting	Maintain current level of hunting throughout the Complex.	Maintain current days of hunting with greater emphasis on the quality and safety of the hunting program and additional youth and disabled hunting opportunities.	Maximize numbers of hunters and use days throughout the Complex, opening up all refuges to all types of hunting allowed by state regulations.	Same as Alternative B

Issues	Alternative A (Current Management)	Alternative B (Preferred Alternative)	Alternative C (Public Use Emphasis)	Alternative D (Interior Forest Emphasis)
Fishing	Maintain current emphasis on fishing opportunities at all refuges, except Yazoo (due to contaminant levels).	Same as Alternative A, except provide additional deep-water habitat at Morgan Brake and Carter Tract and additional facilities at Panther Swamp.	Same as Alternative B, except additional former catfish ponds, with acceptable consumptive contaminant levels, will be converted from moist-soil to deep-water habitats and opened to public fishing.	Same as Alternative A
ATV use	Sixty-five miles of trails will be available to visitors for hunting and fishing with no recurring maintenance. No new trails will be created.	Some trails will be eliminated or diverted due to access issues, impacts to habitat, and duplication of trails. No off-trail use will be permitted in accordance with regulations pertaining to federal lands. ATV-free zones will be created on Morgan Brake and Panther Swamp to provide solitude. ATV use fee created to support trail maintenance.	Same as Alternative A, except funding will be made available for trail maintenance and an ATV use fee created. Off trail retrieval of deer will be permitted.	Same as Alternative B, except trails will be evaluated for their impacts to interior forest habitat.

Issues	Alternative A (Current Management)	Alternative B (Preferred Alternative)	Alternative C (Public Use Emphasis)	Alternative D (Interior Forest Emphasis)
Facilities	No environmental education facilities.	New headquarters, subheadquarters, and visitor contact stations will incorporate accommodations for outdoor classrooms, parking, restrooms, and other facilities.	Same as Alternative B	Same as Alternative B
Low public awareness of the purpose and mission of the Complex and the National Wildlife Refuge System (Interpretation).	Few visitors will know they are on a national wildlife refuge managed primarily for migratory birds and other federal trust species.	Design a comprehensive outreach program to educate and inform all visitors, legislators, partners, and communities about the purpose and mission of the Complex and the National Wildlife Refuge System. Develop a Friends Group for each of the headquarters.	Same as Alternative B	Same as Alternative B

Issues	Alternative A (Current Management)	Alternative B (Preferred Alternative)	Alternative C (Public Use Emphasis)	Alternative D (Interior Forest Emphasis)
Wildlife Observation and Photography	Maintain current facilities, including nature trail at Hillside and observation platforms at Yazoo.	Same as Alternative A except expand current facilities by including brochures on watchable wildlife, photo blinds, canoe trails (Yazoo, Panther Swamp, and Mathews Brake) and wildlife drives (Yazoo and Panther).	Same as Alternative B	Same as Alternative B
Environmental Education	Accommodate on a case-by-case basis.	Develop regularly scheduled programs at visitor center and form partnerships with local schools.	Same as Alternative B	Same as Alternative A
Resource Threats				
Contaminants	Conduct incidental monitoring of contaminants on refuge lands and waters.	Cooperate with state and federal agencies to institute a structured monitoring of contaminants, determine sources, and investigate means to reduce impacts.	Same as Alternative B, except efforts would be focused on reducing contaminants on Yazoo to restore the fishery.	Same as Alternative B

Issues	Alternative A (Current Management)	Alternative B (Preferred Alternative)	Alternative C (Public Use Emphasis)	Alternative D (Interior Forest Emphasis)
Siltation	No active management	Cooperate with state and federal agencies to reduce impacts from off-refuge sources.	Same as Alternative B, except efforts would be focused on impacts primarily to refuge waters used for public fishing.	Same as alternative B
Loess bluff habitat development	Continue efforts to acquire bluff habitat within the current acquisition boundaries of Morgan Brake and Hillside.	Same as Alternative A	Same as Alternative A	Same as Alternative A
Water level management on Mathews Brake	Continue to allow the brake to silt in, retain the beaver dam to hold water, and maintain agreements with adjacent landowners to control the water levels.	Work with the COE to divert water back into the brake, remove the beaver dam, and install a proper water control structure for greater control of water levels to provide habitat for wintering waterfowl.	Same as Alternative B, except equal emphasis would be placed on fishery resources in the brake.	Same as Alternative B
Land Protection				
Yazoo land protection	Continue to acquire land, from willing sellers, within the current acquisition boundary.	Same as Alternative A, except priority would be given to lands on the west to address off-refuge siltation and contamination impacts.	Same as Alternative A, except efforts would be focused on those acres that would provide additional public use opportunities.	Same as Alternative A, except efforts would be focused on those acres that contribute to the creation of the interior forest habitat.

Issues	Alternative A (Current Management)	Alternative B (Preferred Alternative)	Alternative C (Public Use Emphasis)	Alternative D (Interior Forest Emphasis)
Panther Swamp land protection	Continue to acquire land, from willing sellers, within the current acquisition boundary.	Same as Alternative A, except priority would be given to lands on the east to address off-refuge siltation and contamination impacts.	Same as Alternative A, except efforts would be focused on those acres that would provide additional public use opportunities.	Same as Alternative A, except efforts would be focused on those acres that contribute to the creation of the interior forest habitat.
Hillside and Morgan Brake land protection	Continue to acquire land, from willing sellers, within the current acquisition boundary.	Same as Alternative A, except expand current boundary priority on lands to the east to protect loess bluff habitat.	Same as Alternative A, except focus efforts on those acres that would provide additional public use opportunities.	Same as Alternative A
Mathews Brake land protection	Continue to acquire land, from willing sellers, within the current acquisition boundary.	Same as Alternative A	Same as Alternative A, except focus efforts on those acres that would provide additional public use opportunities.	Same as Alternative A
Private Lands	Continue current level of outreach and assistance to restore habitats on private lands.	Focus efforts to restore/protect 2,000 acres annually within a focus area that provides the greatest benefit to threatened habitats and objectives of national and regional plans for federal trust species.	Same as Alternative A	Same as Alternative B except priority would be given to those projects that contribute to the creation or expansion of interior forest habitat.

Issues	Alternative A (Current Management)	Alternative B (Preferred Alternative)	Alternative C (Public Use Emphasis)	Alternative D (Interior Forest Emphasis)
Lack of established programs and partners	Continue current level of partnerships, which are initiated by organizations wanting to research or contribute to the Complex resources.	Develop a program that outlines partnership opportunities for research and land protection throughout the Complex.	Same as Alternative B, except focus of partnership opportunities would involve visitor services	Same as Alternative B except focus efforts on interior forest creation and management.
Cultural Resources	25,000 acres of refuge lands have been surveyed for cultural resources.	Complete survey of refuge lands and create a GIS data layer identifying sensitive sites, protecting them from refuge and visitor services programs	Same as Alternative B	Same as Alternative B
Refuge Administration				
Facilities	Maintain and rehabilitate current facilities.	Replace headquarters office at Yazoo and subheadquarters' offices at Panther Swamp and Morgan Brake, and improve all visitor facilities to provide services to larger groups, including parking and restrooms.	Same as Alternative B	Same as Alternative B

Issues	Alternative A (Current Management)	Alternative B (Preferred Alternative)	Alternative C (Public Use Emphasis)	Alternative D (Interior Forest Emphasis)
Staff	Utilize 18 current FTEs to execute and protect current Complex land and programs.	Add 31 additional staff to manage a complex of habitats to meet and exceed habitat objectives, address maintenance backlogs, and develop and execute an effective Visitor Services program.	Focus current 18 FTEs on visitor services programs, adding 13 additional positions for outreach and recreational programs and law enforcement.	Add 20 additional staff to restore and manage interior forest habitat, conduct maintenance programs, and conduct an effective visitor services program.
Law Enforcement	Maintain the current level of law enforcement focusing the efforts of one full-time officer and six dual function officers on hunting and fishing programs.	Same as Alternative A, except recruit one full-time officer for each headquarters, one additional officer for the Complex, and three seasonal officers during hunting seasons.	Same as Alternative B	Same as Alternative B

III. Affected Environment

See Chapter III, of the Draft Comprehensive Conservation Plan for Theodore Roosevelt National Wildlife Refuge Complex.

IV. Environmental Consequences

This section analyzes and discusses the potential environmental effects or consequences that can be reasonably expected by the implementation of each of the four management alternatives described in Chapter III of this environmental assessment. These topics were chosen based on the important issues and concerns raised at the public scoping meeting and the planning team meetings. However, a few potential effects would be the same under each alternative and are summarized below.

EFFECTS COMMON TO ALL ALTERNATIVES

COMPATIBLE USES. The National Wildlife Refuge System Administration Act of 1966, as amended by the National Wildlife Refuge System Improvement Act of 1997, states that national wildlife refuges must be protected from incompatible or harmful human activities. Before activities or uses are allowed on a national wildlife refuge, the uses must be found to be compatible. A compatible use "...will not materially interfere with or detract from the fulfillment of the mission of the refuge system or the purposes of the refuge." "Wildlife-dependent recreational uses may be authorized on a refuge when they are compatible and not inconsistent with public safety."

An interim compatibility determination is a document that assesses the compatibility of an activity during the period of time the Service first acquires a parcel of land to the time a formal, long-term management plan for that parcel is prepared and adopted. The Service has completed an interim compatibility determination for the six priority general public uses of the system, as listed in the National Wildlife Refuge System Improvement Act. These uses are hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation.

ENVIRONMENTAL JUSTICE. Executive Order 12898 "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" was signed by President Clinton on February 11, 1994, to focus federal attention on the environmental and human health conditions of minority and low-income populations with the goal of achieving environmental protection for all communities. The Order directed federal agencies to develop environmental justice strategies to aid in identifying and addressing disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority and low-income populations. The Order is also intended to promote nondiscrimination in federal programs substantially affecting human health and the environment, and to provide minority and low-income communities access to public information and participation in matters relating to human health or the environment.

None of the management alternatives described in this environmental assessment will disproportionately place any adverse environmental, economic, social, or health impacts on minority and low-income populations. Implementation of any action alternative that includes public use and environmental education will actually provide a benefit to the residents residing in the surrounding communities**.**

CO-MANAGEMENT OF LANDS WITH U.S. ARMY CORPS OF ENGINEERS (COE). Both Yazoo and Panther Swamp refuges contain water control structures and levees that are maintained by the COE for flood control. Hillside and Panther Swamp refuges both have perpetual management agreements with the COE. Panther Swamp refuge contains over 7,000 acres of mitigation lands that must be managed as bottomland hardwoods. Hillside refuge is part of the Yazoo Basin Headwater Project and serves as a siltation collection sump for the Yazoo River.

Each alternative honors the agreements signed between the COE and the Service with increased interaction and little to no impacts to current COE programs.

CLIMATE CHANGE IMPACTS. The U.S. Department of the Interior issued an order in January 2001 requiring federal agencies under its direction that have land management responsibilities to consider potential climate change impacts as part of long-range planning endeavors.

The increase of carbon within the earth's atmosphere has been linked to the gradual rise in surface temperature commonly referred to as global warming. In relation to comprehensive planning for national wildlife refuges, carbon sequestration constitutes the primary climate-related impact to be considered in planning. The U.S. Department of Energy's "Carbon Sequestration Research and Development: (U.S. DOE 1999) defines carbon sequestration as "...the capture and secure storage of carbon that would otherwise be emitted to or remain in the atmosphere."

The land is a tremendous force in carbon sequestration. Terrestrial biomes of all sorts (e.g., grasslands, forests, wetlands, tundra, perpetual ice, and desert) are effective both in preventing carbon emission and acting as a biological "scrubber" of atmospheric carbon monoxide. A report by the Department of Energy concluded that ecosystem protection is important to carbon sequestration and may reduce or prevent loss of carbon currently stored in the terrestrial biosphere.

Preserving natural habitat for wildlife is the heart of any long-range plan for national wildlife refuges. The actions proposed in the comprehensive conservation plan would preserve or restore land and water, and would thus enhance carbon sequestration. This, in turn, contributes positively to efforts to mitigate human-induced global climate changes.

OTHER MANAGEMENT. All management activities that could affect natural resources, including subsurface mineral reservations, utility lines and easements, soil, water and air, and historical and archaeological resources, would be managed to comply with all laws and regulations.

CULTURAL RESOURCES. Currently, 25,000 acres have been surveyed for cultural resources. Five sites on Yazoo refuge were registered with the "National Register of Historic Places." Prior to all habitat and facility maintenance activities, appropriate efforts would be made to identify known and possible cultural resources within the area of potential impact. Avoidance of cultural resources would be the preferred treatment.

LAND ACQUISITION. Funding for land acquisition from willing sellers within the acquisition boundary would come from the Land and Water Conservation Fund, Migratory Bird Conservation Fund, Corps of Engineers mitigation programs, Mississippi Department of Transportation mitigation programs, or donations from conservation and private organizations. Conservation easements and leases can be used to obtain minimum interests necessary to satisfy refuge objectives, if the refuge staff can adequately manage uses of the areas for the benefit of wildlife. The Service can negotiate management agreements with local, state, and federal agencies, and accept conservation easements. Some tracts within the proposed refuge acquisition boundary may be owned by other public or private conservation organizations. The Service would work with interested organizations to identify additional areas needing protection and provide technical assistance if needed. The acquisition of private lands is entirely contingent on the landowners and their willingness to participate.

REFUGE REVENUE-SHARING. Annual refuge revenue-sharing payments to Washington, Warren, Yazoo, Holmes, Humphreys, and Leflore counties would continue at similar rates under each alternative. If lands are acquired and added to the refuge, the payments would increase accordingly.

EXPANSION OF VISITOR SERVICES. As the visitor services program is developed, the staff would continue to assess the program and its potential impact on Complex resources. Changes in the program would be implemented as needed to address any impacts identified and to respond to anticipated wildlife population increases. To ensure a quality wildlife-dependent recreation experience while achieving the "wildlife first" mandate, the number of users and conflicts among users may be limited by the following: (1) limited permits; (2) designating roads, trails, and sites for specific kinds of wildlife-dependent recreational use; and (3) permitting uses at certain times of the year.

There are a number of situations where future refuge closures or restrictions on access may be warranted. Examples of these situations include, but are not limited to, the following: protection of endangered species; protection of nesting birds; restriction of recreation activities to achieve specific wildlife population objectives; to improve the quality of hunting experiences; minimization of conflicts with other refuge management programs; flooding or other natural disasters and limitations from inadequate funds and/or staff to administer use.

Refuge Administration. The maintenance and operation of the refuge's administrative facilities would continue, regardless of the alternative selected. Periodic updating of facilities is necessary for safety and accessibility and to support staff and management needs. Funding needs have been identified for several projects, including providing additional facilities and equipment to support refuge operation and maintenance.

COMPARISON OF EFFECTS BY ALTERNATIVE

The following section describes the environmental consequences of adopting each refuge management alternative. Table 21 addresses the likely outcomes for specific issues and is organized by broad issues categories.

ALTERNATIVE A: NO ACTION (Current Situation)

Current refuge management and public outreach practices would be favored under this alternative. It assumes that current conservation management and land protection programs and activities by the Service, state and local agencies, and private organizations would continue to follow past trends over the next 15 years. Refuge staff would continue to restore and maintain existing wetland, bottomland hardwood, grassland, and open water habitats as funds would become available and with little baseline information collected. Land would be acquired to complete the current approved boundary of 113,060 acres.

The Visitor Services program would continue to focus on hunting and fishing. Current restrictions or prohibitions on recreational activities would remain in place. A new headquarters and visitor contact station would be constructed at Yazoo refuge. The current subheadquarters and associated facilities would be rehabilitated as funding becomes available. No outreach or environmental education programs would be developed meaning that most visitors would remain unaware that they are on a national wildlife refuge managed by the Fish and Wildlife Service under the premise of "Wildlife First."

Chapter II of the draft comprehensive conservation plan contains more detailed information about current conditions.

ALTERNATIVE B: BALANCED HABITAT AND PUBLIC USE EMPHASIS (PREFERRED ALTERNATIVE)

The preferred alternative would promote improved and active management of existing fish, wildlife, and plant habitats and added and higher quality recreational experiences for visitors. Additional staff and resources would create and properly manage current and increased diversity of habitats, including moist-soil, grasslands, scrub/shrub, open-water, and bottomland hardwoods. Forested habitats could receive new and intensive maintenance applications emphasizing structure and desirable species while addressing the current forest management plan on Panther Swamp refuge that is behind established schedules, with added emphasis on the entire Complex. Structures and levees needed to maintain moist-soil habitats could be added and restored. Continual habitat loss through inadequate management programs would be halted and damaged habitats, such as beaver damaged timber stands, would be restored. Other pest and invasive species would be inventoried and controlled through a structured, funded program. Through proper management and partnerships, forest fragmentation would be reduced and sensitive areas protected. Baseline data would be collected on populations and habitats. Facilities would be replaced or upgraded addressing program expansion, safety, health, and visitor services needs.

Land would be acquired to complete the current approved boundaries of 113,060 acres. The Complex would concentrate all future off-refuge programs and partnerships within the "Conservation Partners" Focus Area with an emphasis on contributing to interior forest habitat and meeting the objectives of other regional and national plans.

Visitor services programs would expand into more non-traditional uses, such as wildlife observation, photography, and environmental education and interpretation. Improved interpretive and informational programs would increase awareness of the existence of these refuges and their purposes and the mission of the National Wildlife Refuge System. Quality hunting and fishing programs would be provided, with added emphasis on quality and sound biological principles.

ALTERNATIVE C: PUBLIC USE EMPHASIS

This alternative would emphasize public use of all refuge lands, while maintaining a low maintenance approach to managing habitats. Additional staff and/or volunteers would be added in an effort to increase and manage visitor services programs and on-site public contacts. Current and additional staff time and resources would be shifted to allow for more public activities in all areas of the Complex. Habitats, including moist-soil, bottomland forest, and scrub/shrub, would not be restored or managed. Grasslands would be created to allow for additional hunting opportunities of bobwhite quail.

Control of exotic plants or nuisance wildlife populations would be kept to a minimum unless impacting recreational wildlife species. Invasive plants, such as alligator weed and kudzu, would continue to encroach and impact refuge wetlands and forested habitats.

Land would be acquired to complete the current approved boundary of 113,060 acres. Fishing would be provided on Panther Swamp, Hillside, and Morgan and Mathews Brake refuges. Off-refuge impacts would continue and loess bluff habitat adjacent to Morgan Brake and Hillside refuges would continue to be lost through timber harvest and development.

ALTERNATIVE D: INTERIOR FOREST HABITAT EMPHASIS

Under this alternative, all suitable refuge lands would be reforested in support of migratory birds and other wildlife dependent on interior forest habitats. Most refuge management actions would be directed towards creating and managing the largest amount of interior and corridor forest habitat (for Louisiana black bear, neotropical migratory songbirds, and other interior forest wildlife) and reducing forest fragmentation, while supporting the overall primary purpose for the Complex of preserving wintering habitat for mallards, pintails, and wood ducks; and providing production habitat for wood ducks and other migratory birds dependent on forested habitats. Open habitat maintained for geese on Yazoo refuge would be reforested and farming would be eliminated throughout the Complex. Objectives established in support of national, regional, and state goals to protect and restore waterfowl, shorebird, grassland, and scrub/shrub bird populations would not be met.

High quality wildlife-dependent recreation activities (e.g., hunting, fishing, wildlife observation, and interpretation) would continue and environmental education programs would be developed (focused on interior forest habitat management). Improved interpretive and informational programs would increase awareness of these refuges' existence and their purposes, as well as the mission of the National Wildlife Refuge System. Quality hunting and fishing programs would be provided, consistent with sound biological principles.

Land would be acquired to complete the current approved boundary of 113,060 acres. New refuge lands would contribute to the restoration of interior forest habitats.

The Complex would concentrate all future off-refuge programs and partnerships within the "Conservation Partners" Focus Area with an emphasis on contributing to interior forest habitat.

Table 20. Summary of environmental effects by alternative, Theodore Roosevelt National Wildlife Refuge Complex

Issues	Alternative A (Current Management)	Alternative B (Preferred Alternative)	Alternative C (Public Use Emphasis)	Alternative D (Interior Forest Emphasis)
Migratory Birds				
Waterfowl	Waterfowl populations decrease as habitats continue to deteriorate	Populations and survival rates increase	Populations would decrease	Same as Alternative B, except high calorie foods and other nutritional needs of wintering waterfowl would not be met impacting survival.
Shorebirds	Stable population of shorebirds using the Cox Ponds only	Increased population of shorebirds using the Complex	Decrease in population of shorebirds	Same as Alternative A
Waterbirds (including marsh and colonial birds)	Declining populations using the Complex	Populations and survival rates of waterbirds increase	Same as Alternative A	Same as Alternative A
Songbirds	Numbers and species not monitored; populations continue to decline	Species diversity and populations increase; populations are monitored	Same as Alternative A	Imperiled interior forest species increase; increased nesting habitat; populations are monitored
Raptors	Populations are maintained or decrease	Populations and survival increase	Same as Alternative A	Raptors dependent on forested habitats increase
Woodcock	Populations maintained or decrease	Increasing population and survival rates	Same as Alternative A	Initial populations increase, but decline as forest matures

Issues	Alternative A (Current Management)	Alternative B (Preferred Alternative)	Alternative C (Public Use Emphasis)	Alternative D (Interior Forest Emphasis)
Habitats				
Moist Soil	Slight increase as funds are available for restoration and management	Increased through restoration and management	Decreased. No active management	Decrease as additional lands are reforested
Bottomland Hardwood Forest	Increase and quality improved on Panther Swamp as management plan continues to be implemented; however, the remaining refuges and rate of progress throughout the Complex continues to fall behind schedule.	The health and habitat value is improved through management and natural regeneration.	Decreased. No active management	Increased with intense restoration with native trees
Interior forest	Decreasing interior forest habitat on Panther Swamp due to lack of staff and resources for proper management, including controlling beaver damage to existing forests.	Maintain and increase through proper management, research, and partnerships linking fragmented forested habitats	Same as Alternative A	Same as Alternative B, except an additional interior forest habitat created or expanded throughout the Complex.

Issues	Alternative A (Current Management)	Alternative B (Preferred Alternative)	Alternative C (Public Use Emphasis)	Alternative D (Interior Forest Emphasis)
Loess bluffs	Maintained and protected	Increased protection, understanding, and management	Same as Alternative A	Same as Alternative B
Scrub/shrub	Decreasing as reforested habitat grows	Same as Alternative A, except additional acres would be added and maintained on converted croplands	Same as Alternative A	Same as Alternative A
Grasslands	Decreasing	Increased as additional acres would be created and maintained	Same as Alternative B	Same as Alternative A
Croplands for waterfowl	Maintained; continued soil erosion siltation of wetlands	Decreasing; decreased soil erosion and siltation	Same as Alternative A	Eliminated
Open water	Current acres maintained	Increasing	Same as Alternative B	Same as Alternative A
Other Fish, Wildlife, and Plants				
Invasive species	Increase; some invasive species and rate of spread unknown	Identified and decreased or eradicated	Invasive species impacting recreational wildlife decreased	Same as Alternative B
Pest Management	Pest species increase decreasing desirable habitats and management capabilities	Pest species identified, inventoried, and decreased while habitats are restored	Pest species increase	Same as Alternative B

Issues	Alternative A (Current Management)	Alternative B (Preferred Alternative)	Alternative C (Public Use Emphasis)	Alternative D (Interior Forest Emphasis)
Threatened and endangered (T&E) species (Federal)	Known populations increase but no complete inventory and protection of additional T&E species	All T&E species are identified and inventoried and populations are maintained or increased	Populations decrease	Known species and populations maintained with increases in interior forest-dependent species
White-tailed deer	Maintained and managed for a quality herd for hunting	Same as Alternative A, except population managed based on identified impacts to habitats for federal trust species.	Same as Alternative A	Same as Alternative B
Upland game birds	Population levels unpredictable; no active management	Substantial increases with additional opportunities for hunting	Same as Alternative B	Short-term increases while reforested areas mature
Amphibians and reptiles	Species and impacts unknown; decreasing	Identified and protected; increasing	Same as Alternative A	Same as Alternative B
Fisheries	Populations and species diversity decreases as contaminants and siltation continue to impact waterways	Increased populations with new habitats and off-refuge impacts reduced.	Increase in fisheries resources with severe impacts to habitats needed for migratory waterbirds.	Same as Alternative A

Issues	Alternative A (Current Management)	Alternative B (Preferred Alternative)	Alternative C (Public Use Emphasis)	Alternative D (Interior Forest Emphasis)
Visitor Services and Recreation				
Hunting	Maintained at current levels	Maintained with increased opportunities for upland game bird hunting, and youth, seniors, and disabled hunts (including designated areas)	Increased hunting opportunities; decreased quality and safety; trust species populations decreased by loss of habitat and sanctuary	Same as Alternative B
Fishing	Maintained	Increased; integrated into habitat management for federal trust species	Increase at a level that would impact habitats needed for federal trust species	Same as Alternative A
ATV use	Continuing impacts to habitat, hydrology, air and noise pollution, and wildlife	Decreased impacts due to proper trail maintenance and ATV free zones, reducing noise pollution	Increased impacts due to increased public use	Same as Alternative B except trails will be evaluated for their impacts to interior forest habitat.
Facilities	Continued impacts to staff and visitor safety as facilities continue to deteriorate	Facilities will be developed with minimal impacts to refuge resources	Same as Alternative B	Same as Alternative B
Lack of public awareness of the purpose and mission of the Complex and the National Wildlife Refuge System (Interpretation)	Current level of awareness maintained or decreased as informative or interpretive displays and signs degrade	Awareness and understanding increased	Same as Alternative B	Same as Alternative B

Issues	Alternative A (Current Management)	Alternative B (Preferred Alternative)	Alternative C (Public Use Emphasis)	Alternative D (Interior Forest Emphasis)
Wildlife Observation and Photography	Maintained	Disturbance to wildlife monitored and reduced through facilities and planning	Same as Alternative B	Same as Alternative B
Environmental Education	Continue at current level	Greater opportunities for education should lead to increased understanding of importance of habitat and resources.	Same as Alternative B	
Resource Threats Contaminants	Increased	Decreased	Decreased to restore fishing opportunities on Yazoo	Same as Alternative B
Siltation	Increased	Decreased	Decreased in areas open to public fishing	Same as Alternative B
Loess bluff habitat development	Current acres maintained with increased protection within current acquisition boundary	Same as Alternative A, except up to 10 percent of current acquisition acres would be added for protection	Same as Alternative A	Same as Alternative B
Water level management and retention of habitats on Mathews Brake	Loss of habitat and increased contamination	Improved water level management improving habitat for wintering waterfowl	Same as Alternative B except equal emphasis will be placed on fishery resources in the brake	Same as Alternative B

Issues	Alternative A (Current Management)	Alternative B (Preferred Alternative)	Alternative C (Public Use Emphasis)	Alternative D (Interior Forest Emphasis)
Land Protection				
Yazoo land protection	Increase protection of additional acres within current ownership	Same as Alternative A, except acquire additional acres within acquisition boundary with emphasis on decreasing sedimentation and contamination of refuge resources.	Same as Alternative B, except additional acres will provide increased public use	Same as Alternative B except additional lands will contribute to interior forest creation.
Panther Swamp land protection	Increase protection of additional acres within current ownership	Same as Alternative A, except acquire additional acres within acquisition boundary with emphasis on decreasing sedimentation and contamination of refuge resources.	Same as Alternative B, except additional acres will provide increased public use	Same as Alternative B, except additional lands will contribute to interior forest creation.
Hillside and Morgan Brake land protection	Increase protection of additional acres within current ownership	Same as Alternative A acquire additional acres within acquisition boundary with emphasis on decreasing sedimentation and contamination of refuge resources.	Same as Alternative B, except additional acres will provide increased public use	Same as Alternative B

Issues	Alternative A (Current Management)	Alternative B (Preferred Alternative)	Alternative C (Public Use Emphasis)	Alternative D (Interior Forest Emphasis)
Mathews Brake land protection	Increase protection of additional acres within current ownership	Same as Alternative A	Increase with emphasis on lands suitable for public use	Increase lands protected and restoration of forested habitats
Lack of established programs and partners	Maintain and increase as approached by interested partners	Increased understanding and protection of resources and increased Visitor Services programs.	Increased Visitor Services programs through partnerships	Same as Alternative B, except with emphasis on interior forest restoration
Private Lands	Maintain current level of assistance with continued restoration and protection of private lands	Increase efforts within "Conservation Partners" Focus Area to ensure objectives of national and regional plans are addressed and off-refuge impacts are reduced.	Same as Alternative A	Same as Alternative B except priority will be given to those projects that contribute to the creation or expansion of interior forest habitat.
Refuge Administration				
Facilities	Maintain current programs and level of protection and enhancement	Increase and improve management capabilities, increase visitor safety, and provide economic benefits to local communities	Increase visitor safety, orientation, and opportunities while providing economic impact to local communities.	Same as Alternative B

Issues	Alternative A (Current Management)	Alternative B (Preferred Alternative)	Alternative C (Public Use Emphasis)	Alternative D (Interior Forest Emphasis)
Staff	Maintain current program levels with little baseline data and continued eroding of habitats.	Create a comprehensive program that will improve and address all aspects of refuge management.	Increase visitor services programs	Restore, maintain, and manage interior forest habitats.
Law Enforcement	Maintain current program while other management programs are neglected during hunting seasons.	Increase protection of refuge resources and visitor safety with little to no impact on resource management and maintenance programs	Same as Alternative B	Same as Alternative B
Other Human Dimensions				
Human health	Continued impacts to water quality through siltation and contamination due to agricultural production.	Overall improvements to human health (improved air and water quality) as habitats are restored, decreasing siltation and contamination and increasing carbon sequestration.	Few benefits to human health.	Same as Alternative B.

Issues	Alternative A (Current Management)	Alternative B (Preferred Alternative)	Alternative C (Public Use Emphasis)	Alternative D (Interior Forest Emphasis)
Socioeconomic	Eventual losses as wildlife populations and diversity decline due to continued habitat losses from lack of adequate funding and resources.	Increased benefits to local economy due to added staff living in communities, improved wildlife diversity and populations, and new visitor services programs and facilities. Some impacts to cooperative farmers due to eventual reductions in agricultural acres.	Initial economic benefits as public use increases with eventual declines as wildlife populations, dependent on public use programs, begin to decline.	Same as Alternative B

V. Consultation and Coordination

The Theodore Roosevelt National Wildlife Refuge Complex Comprehensive Conservation Plan and Environmental Assessment have been written with the participation of Service staff, refuge users, and the local community. The planning process began August 2000, with the formation of a Complex planning team (Table 21). Initially, the team focused on identifying the issues and concerns pertinent to refuge management. The team met on several occasions from August 2000 to December 2001. During this period, the team sought the contributions of experts (Table 22) from various fields. A team of biologists and public use specialists from the state, non-profit conservation organizations, other federal agencies, and universities conducted three comprehensive biological reviews and two public use reviews. The planning team's recommendations provided valuable information for the authors of this plan. Consequently, the Complex hosted three public scoping meetings and began an outreach campaign through various media to collect ideas and concerns from all interested parties. Focus groups addressed specific issues refining review team recommendations. Please see Chapter II of the Comprehensive Conservation Plan for more information on the public scoping process.

Table 21. Theodore Roosevelt National Wildlife Refuge Complex planning team members.

Planning Team Member	Location
Ray Aycock, Supervisory Fish and Wildlife Biologist,	Ecological Services Jackson, Mississippi
Tim Wilkins, Project Leader,	Theodore Roosevelt Complex Hollandale, Mississippi
Raye Nilius, Deputy Project Leader,	Theodore Roosevelt Complex Hollandale, Mississippi
Laura King, Natural Resource Planner (former),	Theodore Roosevelt Complex Hollandale, Mississippi
Jeff King, Deputy Project Leader (former),	Theodore Roosevelt Complex Hollandale, Mississippi
Bob Strader, Supervisory Wildlife Management Biologist,	Wildlife and Habitat Management Office Jackson, Mississippi
W.F. Stevens, Refuge Manager,	Morgan Brake, Hillside, & Mathews Brake NWRs Tchula, Mississippi
Travis Carpenter, Refuge Manager (former),	Morgan Brake, Hillside, & Mathews Brake NWRs Tchula, Mississippi
Chris Woodson, Refuge Manager (former),	Morgan Brake, Hillside, & Mathews Brake NWRs Tchula, Mississippi
Donna Stanek, Outdoor Recreation Planner (former),	Lower Mississippi Valley Ecosystem Crossett, Arkansas
Mike Dawson, Refuge Planner,	Jackson, Mississippi
Charles Baxter, Joint Venture Coordinator,	Lower Mississippi Valley Joint Venture Office Vicksburg, Mississippi

Table 22. Contributors to the Theodore Roosevelt National Wildlife Refuge Complex Comprehensive Conservation Plan and their area(s) of expertise.

Name	Field of Expertise
Blaine Elliott, Cartographer, Fish and Wildlife Service, Lower Mississippi Valley Joint Venture Office, Vicksburg, Mississippi	Geographical information system, cartography
Frank Bowers, Supervisory Wildlife Biologist, Fish and Wildlife Service, Wildlife and Habitat Management, Southeast Regional Office, Atlanta, Georgia	Wildlife management, ecosystem management, waterfowl management, NAWMP
Rodney Hudspeth, District Conservationist, Department of Agriculture, Natural Resources Conservation Service, Greenville, Mississippi	Farming, Soil and water conservation
Bubber Carnathan, Law Enforcement Officer, Fish and Wildlife Service, Theodore Roosevelt Complex, Hollandale, Mississippi	Wildlife law enforcement, visitor protection
Dawn Zirillo, Fish and Wildlife Service, Sabine National Wildlife Refuge, Hackberry, Louisiana	Visitor Services, Environmental Education
Byron Fortier, Outdoor Recreation Planner, Fish and Wildlife Service, Southeast Louisiana National Wildlife Refuges, Slidell, Louisiana	Visitor Services
Chuck Hunter, Migratory Bird Biologist, Fish and Wildlife Service, Atlanta, Georgia	Migratory bird management
David Linden, Wildlife Biologist, Fish and Wildlife Service, Theodore Roosevelt Complex, Hollandale, Mississippi	Moist-soil management, species lists, resident wildlife
Lamar Dorris, Administrative Forester, Fish and Wildlife Service, Theodore Roosevelt Complex, Hollandale, Mississippi	Forest management
Richard Kanaski, Regional Archaeologist, Fish and Wildlife Service, Savannah, Georgia	Cultural resources
Emile Gardiner, Forester, USDA Forest Service, Stoneville, Mississippi	Forest management
Mark Woodrey, Avian Ecologist, (former), Mississippi Museum of Natural History, and Nongame Bird Biologist (former), Fish and Wildlife Service, Wildlife and Habitat Management Jackson, Mississippi	Migratory Birds, shorebirds
Scott Baker, Wildlife Biologist, Mississippi Department of Wildlife, Fisheries, and Parks, Batesville, Mississippi	Waterfowl management, resident wildlife, hunting

Name	Field of Expertise
Nathan Schiff, Research Entomologist, USDA Forest Service, Stoneville, Mississippi	Entomology (Insects)
John Forester, Fisheries Biologist, Fish and Wildlife Service, Baton Rouge Fisheries Office, Baton Rouge, Louisiana	Fisheries management
Randy Wilson, Evaluation Coordinator, Fish and Wildlife Service, Lower Mississippi Valley Joint Venture Office, Vicksburg, Mississippi	PIF and NAWMP, step-down habitat objectives
Paul Hamel, Research Wildlife Biologist, USDA Forest Service, Stoneville, Mississippi	Non-game birds
Wes Burger, Avian Ecologist, Associate Professor, Mississippi State University, Mississippi	Bobwhite quail, waterfowl management
Billy Frey, Biological Technician, Fish and Wildlife Service, Morgan Brake NWR, Tchula, Mississippi	Farming practices
Rick Kaminski, Professor, Mississippi State University, Mississippi	Waterfowl management, moist soil
Mike Taylor, Environmental Administrator, Mississippi Department of Environmental Quality, Pearl, Mississippi	Contaminants, water quality
Kevin Sloan, Federal Projects Biologist, Fish and Wildlife Service, Wildlife and Habitat Management, Jackson, Mississippi	Ecosystem management
Rick Dillard, Fish and Wildlife Program Manager, USDA Forest Service, Jackson, Mississippi	Fisheries
Don Orr, Wildlife Biologist, Fish and Wildlife Service, Migratory Birds, Memphis, Tennessee	Waterfowl management, geese
Dan Twedt, Research Wildlife Biologist, U.S. Geological Service, Lower Mississippi Valley Joint Venture, Vicksburg, Mississippi	Non-game birds
Kenneth Reinecke, Research Wildlife Biologist, U.S. Geological Service, Lower Mississippi Valley Joint Venture, Vicksburg, Mississippi	Waterfowl research
Dagmar Thurmond, Ecologist, Delta National Forest, USDA Forest Service, Rolling Fork, Mississippi	Non-game wildlife, forest management
Robert Barkley, Refuge Operations Specialist, Fish and Wildlife Service, North Mississippi Refuge Complex, Grenada, Mississippi	Refuge management, Farm Service Agency properties, waterfowl management
Pat Stinson, Wildlife Biologist, Fish and Wildlife Service, Wildlife and Habitat Management, Jackson, Mississippi	Black bear, waterfowl management

Name	Field of Expertise
Johnny Kiser, District Ranger, U.S. Army Corps of Engineers, Vicksburg, Mississippi	Forest Management
Bruce Reid, Director of Bird Conservation, Audubon Society, Vicksburg, Mississippi	Ornithology
Lloyd Inmon, Contaminants Specialist, Fish and Wildlife Service, Jackson, Mississippi	Contaminants, siltation
Larry Moore, Regional Forester, Delta National Forest, USDA Forest Service, Rolling Fork, Mississippi	Forestry

Appendix I. Glossary

adaptive management	a process in which projects are implemented within a framework of scientifically driven experiments to test predictions and assumptions outlined within the comprehensive conservation plan. The analysis of the outcome of project implementation helps managers determine whether current management should continue as is or whether it should be modified to achieve desired conditions.
Alternative	a reasonable way to fix the identified problem or satisfy the stated need (40 CFR 1500.2) [see also management alternative below].
approved acquisition boundary	a project boundary which the Director of the Fish and Wildlife Service approves upon completion of the detailed planning and environmental compliance process.
Aquatic	growing in, living in, or dependent upon water.
biological integrity	composition, structure, and function at the genetic, organism, and community levels consistent with natural conditions, and the biological processes that shape genomes, organisms, and communities.
biological or natural diversity	the abundance, variety, and genetic constitution of animals and plants in nature. Also referred to as “biodiversity.”
breeding habitat	habitat used by migratory birds or other animals during the breeding season.
buffer zones	protective land borders around critical habitats or water bodies that reduce runoff and nonpoint source pollution loading; areas created or sustained to lessen the negative effects of land development on animals and plants and their habitats.
candidate species	those species for which the Service has on file sufficient information on biological vulnerability and threats to propose them for listing.

Canopy	a layer of foliage; generally the upper-most layer, in a forest stand. It can be used to refer to mid- or under-story vegetation in multi-layered stands. Canopy colsure is an estimate of the amount of overhead tree cover (also canopy cover).
carrying capacity	the size of the population that can be sustained by a given environment.
Categorical Exclusion (CE, CX, CATEX, CATX)	a category of actions that do not individually or cumulatively have a significant effect on the human environment and have been found to have no such effect in procedures adopted by a Federal agency pursuant to the National Environmental Policy Act (40 CFR 1508.4).
CFR	Code of Federal Regulations.
Challenge Cost Share Program	a grant program administered by the Fish and Wildlife Service providing matching funds for projects supporting natural resource education, management, restoration and protection on Service lands, other public lands and on private lands.
Community	the area or locality in which a group of people resides and shares the same government.
community type	a particular assemblage of plants and animals, named for the characteristic plants.
compatible use	an allowed use that will not materially interfere with, or detract from, the purposes for which the unit was established (Service Manual 602 FW 1.4).
compatibility determination	a compatibility determination is required for a wildlife-dependant recreational use or any other public use of a refuge. A compatible use is one which, in the sound professional judgment of the Refuge Manager, will not materially interfere with or detract from fulfillment of the Refuge System Mission or refuge purpose(s)
Comprehensive Conservation Plan (CCP)	a document that describes the desired future conditions of a refuge or planning unit and provides long-range guidance and management direction to achieve the purposes of the refuge, help fulfill the mission of the System, maintain and, where appropriate, restore the biological integrity, diversity, and environmental health of each refuge and the System, and meet other mandates.
Concern	see issue.

Conservation	the management of natural resources to prevent loss or waste. Management actions may include preservation, restoration, and enhancement.
conservation agreements	written agreements reached among two or more parties for the purpose of ensuring the survival and welfare of unlisted species of fish and wildlife and/or their habitats, or to achieve other specified conservation goals. Participants voluntarily commit to implementing specific actions that will remove or reduce the threats to these species.
conservation easement	a legal agreement between a landowner and a land trust (a private, nonprofit conservation organization) or government agency that permanently limits a property's uses in order to protect its conservation values. A perpetual conservation easement usually grants conservation and management rights to a party in perpetuity.
cooperative agreement	the legal instrument used when the principal purpose of the transaction is the transfer of money, property, services or anything of value to a recipient in order to accomplish a public purpose authorized by Federal statute and substantial involvement between the Service and the recipient is anticipated.
Corridor	see wildlife corridor.
cover type	the present vegetation of an area.
cultural resources	evidence of historic or prehistoric human activity, such as buildings, artifacts, archaeological sites, documents, or oral or written history.
cultural resource inventory	a professionally conducted study designed to locate and evaluate evidence of cultural resources present within a defined geographic area. Inventories may involve various levels, including background literature search, comprehensive field examination to identify all exposed physical manifestations of cultural resources, or sample inventory to project site distribution and density over a larger area. Evaluation of identified cultural resources to determine eligibility for the National Register follows the criteria found in 36 CFR 60.4 (Service Manual 614 FW 1.7).

cultural resource overview	a comprehensive document prepared for a field office that discusses, among other things, its prehistory and cultural history, the nature and extent of known cultural resources, previous research, management objectives, resource management conflicts or issues, and a general statement on how program objectives should be met and conflicts resolved. An overview should reference or incorporate information form a field offices background or literature search described in Section VIII. of the Cultural Resource Management Handbook (Service Manual 614 FW 1.7).
cypress and tupelo swamp	found in low-lying areas-swales and open ponds-that hold water several months, if not all of the year.
database	a collection of data arranged for ease and speed of analysis and retrieval, usually computerized.
Deciduous	pertaining to perennial plants that are leafless for sometime during the year.
Digitizing	the process of converting information from paper maps into geographically referenced electronic files for a geographic information system (GIS).
Easement	an agreement by which a landowner gives up or sells one of the rights on his/her property. For example, a landowner may donate a right of way across his/her property to allow community members access.
ecological succession	the orderly progression of an area through time in the absence of disturbance from one vegetative community to another.
Ecosystem	a biological community together with its environment, functioning as a unit. For administrative purposes, the Service has designated 53 ecosystems covering the United States and its possessions. These ecosystems generally correspond with watershed boundaries and vary in their sizes and ecological complexity.
Ecotourism	a type of tourism that maintains and preserves natural resources as a basis for promoting economic growth and development resulting from visitation to an area.
ecosystem approach	a way of looking at socio-economic and environmental information based on ecosystem boundaries, rather than town, city, or county boundaries.

ecosystem-based management	an approach to making decisions based on the characteristics of the ecosystem in which a person or thing belongs. This concept takes into consideration interactions between the plants, animals, and physical characteristics of the environment when making decisions about land use or living resource issues.
ecosystem services	the benefits human populations derive, directly or indirectly, from ecosystem functions (e.g., gas regulation, disturbance regulation, soil formation, pollination, raw materials).
environmental health	the composition, structure, and functioning of soil, water, air, and other abiotic features comparable with historic conditions, including the natural abiotic processes that shape the environment.
emergent wetland	wetlands dominated by erect, rooted, herbaceous plants.
endangered species	a federally protected species which is in danger of extinction throughout all or a significant portion of its range.
endemic species	plants or animals that occur naturally in a certain region and whose distribution is relatively limited to a particular locality.
environmental education	education aimed at producing a citizenry that is knowledgeable concerning the biophysical environment and its associated problems, aware of how to help solve these problems, and motivated to work toward their solution (Stapp et al., 1969).
Environmental Assessment (EA)	A concise public document, prepared in compliance with the National Environmental Policy Act, that briefly discusses the purpose and need for an action, alternatives to such action, and provides sufficient evidence and analysis of impacts to determine whether to prepare an environmental impact statement or finding of no significant impact (40 CFR 1508.9).
Environmental Impact Statement (EIS)	A detailed written statement required by section 102(2)(C) of the National Environmental Policy Act, analyzing the environmental impacts of a proposed action, adverse effects of the project that cannot be avoided, alternative courses of action, short-tern uses of the environment versus the maintenance and enhancement of long-term productivity, and any irreversible and irretrievable commitment of resources (40 CFR 1508.11).

even-aged forest	forest that are composed of trees with a time span of less than 20 years between oldest and youngest individuals.
exemplary community type	an outstanding example of a particular community type.
Extirpated	no longer occurring in a given geographic area.
Fauna	all the vertebrae or invertebrate animals of an area.
federal land	public land owned by the Federal government, including lands such as National Forests, National Parks and National Wildlife Refuges.
federal trust species	all species where the Federal Government has primary jurisdiction including federally threatened or endangered species, migratory birds, anadromous fish, and certain marine mammals.
federally listed species	a species listed under the federal Endangered Species Act of 1973, as amended, either as endangered, threatened or species at risk (formerly candidate species).
fee title	the acquisition of most or all of the rights to a tract of land.
Finding of No Significant Impact (FONSI)	A document prepared in compliance with the National Environmental Policy Act, supported by an environmental assessment, that briefly presents why a Federal action will have no significant effect on the human environment and for which an environmental impact statement, therefore, will not be prepared (40 CFR 1508.13).
Forbs	A flowering plant, excluding grasses, sedges, and rushes, that does not have a woody stem and dies back to the ground at the end of the growing season.
forested land	land dominated by trees. For the purposes of the impacts analysis in this document, all forested land was assumed to have the potential to be occasionally harvested, and forested land owned by timber companies was assumed to be harvested on a more intensive, regular schedule.
forested wetlands	wetlands dominated by trees.

Fragmentation	the process of reducing the size and connectivity of habitat patches. The disruption of extensive habitats into isolated and small patches.
geographic information system (GIS)	a computerized system used to compile, store, analyze and display geographically referenced information. Can be used to overlay information layers containing the distributions of a variety of biological and physical features.
Goal	descriptive, open-ended, and often broad statement of desired future conditions that conveys a purpose but does not define measurable units.
grant agreement	the legal instrument used when the principal purpose of the transaction is the transfer of money, property, services or anything of value to a recipient in order to accomplish a public purpose of support or stimulation authorized by Federal statute and substantial involvement between the Service and the recipient is not anticipated.
grassroots conservation organization	any group of concerned citizens who come together to actively address a conservation need.
ground story	vascular plants less than one meter in height, excluding tree seedlings.
Habitat	the place where a particular type of plant or animal lives. An organism's habitat must provide all of the basic requirements for life and should be free of harmful contaminants.
habitat conservation	the protection of an animal or plant's habitat to ensure that the use of that habitat by the animal or plant is not altered or reduced.
habitat fragmentation	breaking up of a specific habitat into smaller unconnected areas. A habitat area that is too small may not provide enough space to maintain a breeding population of the species in question.
habitat macrosites	an area important because of the presence of rare species, ecological communities, and functioning ecosystems.
herbaceous wetland	annually or seasonally inundated area with vegetation consisting primarily of grasses, sedges, rushes and cattail.

historic conditions	these are the composition, structure, and functioning of ecosystems resulting from natural processes that we believe, based on sound professional judgment, were present prior to substantial human related changes to the landscape.
hydro logic or flow regime	characteristic fluctuations in river flows.
indicator species	a species of plant or animal that is assumed to be sensitive to habitat changes and represents the needs of a larger group of species.
in-holding	privately owned land inside the boundary of a national wildlife refuge.
Integrated Pest Management (IPM)	sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools in a way that minimizes economic, health, and environmental risks.
interjurisdictional fish	populations of fish that are managed by two or more states or national or tribal governments because of the scope of their geographic distributions or migrations.
interpretive facilities	structures that provides information about an event, place or thing by a variety of means including printed materials, audiovisuals or multimedia materials. Examples of these would be kiosks which offer printed materials and audiovisuals, signs and trailheads.
interpretive materials	any tool used to provide or clarify information, explain events or things, or serve to increase awareness and understanding of the events or things. Examples of these would be: (1) printed materials such as brochures, maps or curriculum materials; (2) audio/visual materials such as videotapes, films, slides, or audio tapes; and (3) interactive multimedia materials, such as cd–rom and other computer technology.
invasive exotic species	non-native species which have been introduced into an ecosystem, and, because of their aggressive growth habits and lack of natural predators, displace native species.

issue	any unsettled matter that requires a management decision; e.g., a Service initiative, an opportunity, a management problem, a threat to the resources of the unit, a conflict in uses, a public concerns, or the presence of an undesirable resource condition. Issues should be documented, described, and analyzed in the CCP even if resolution cannot be accomplished during the planning process (Service Manual 602 FW 1.4). See also: key issue.
land trusts	organizations dedicated to conserving land by purchasing land, receiving donations of lands, or accepting conservation easements from landowners.
limiting factor	an environmental limitation that prevents further population growth.
local agencies	generally referring to municipal governments, regional planning commissions or conservation groups.
long term protection	mechanisms such as fee title acquisition, conservation easements or binding agreements with landowners that ensure land use and land management practices will remain compatible with maintenance of the species population at the site.
management alternative	a set of objectives and the strategies needed to accomplish each objective (Service Manual 602 FW 1.4).
management concern	see issue.
management opportunity	see issue.
management plan	a plan that guides future land management practices on a tract of land. In the context of this environmental impact statement, management plans would be designed to produce additional wildlife habitat along with the primary products, such as timber or agricultural crops. See cooperative agreement.
management strategy	a general approach to meet unit objectives. A strategy may be broad, or it may be detailed enough to guide implementation through specific actions, tasks, and projects (Service Manual 602 FW 1.4).
migratory	the seasonal movement from one area to another and back.
migratory game birds	birds regulated under the Migratory Bird Treaty Act and state laws, that are legally hunted, includes ducks, geese, woodcock, rails.

minimum tool rule	Apply only the minimum impact policy, device, force, regulation, or practice to bring about a desired result. Achieve results using the most “light-handed” approach (Hendee, 1990).
Mission statement	succinct statement of the unit's purpose and reason for being (Region 7 Planning Staff).
Mitigation	actions taken to compensate for the negative effects of a particular project. Wetland mitigation usually takes the form of restoration or enhancement of a previously damaged wetland or creation of a new wetland.
monitoring	the process of collecting information to track changes of selected parameters over time.
National Environmental Policy Act of 1969 (NEPA)	requires all agencies, including the Service, to examine the environmental impacts of their actions, incorporate environmental information, and use public participation in the planning and implementation of all actions. Federal agencies must integrate NEPA with other planning requirements, and prepare appropriate NEPA documents to facilitate better environmental decision making (from 40 CFR 1500).
National Wildlife Refuge (Refuge)	“A designated area of land, water, or an interest in land or water within the System, but does not include Coordination Areas.” Find a complete listing of all units of the System in the current Annual Report of Lands Under Control of the U.S. Fish and Wildlife Service.
National Wildlife Refuge System (Refuge System)	all lands and waters and interests therein administered by the Service as wildlife refuges, wildlife ranges, wildlife management areas, waterfowl production areas, and other areas for the protection and conservation of fish and wildlife, including those that are threatened with extinction.
National Wildlife Refuge System Mission (mission)	“The mission of the System is to administer a national network of lands and waters for the conservation, management and, where appropriate, restoration of the fish, wildlife and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.”
native plant	a plant that has grown in the region since the last glaciation and occurred before European settlement.

native species	species that normally live and thrive in a particular ecosystem.
neotropical migratory bird	a bird species that breeds north of the United States/Mexican border and winters primarily south of that border.
non-consumptive, wildlife-oriented recreation	photographing or observing plants, fish and other wildlife.
non-point source pollution	nutrients or toxic substances that enter water from dispersed and uncontrolled sites.
nonforested wetlands	wetlands dominated by shrubs or emergent vegetation.
Notice of Intent (NOI)	a notice that an environmental impact statement will be prepared and considered (40 CFR 1508.22). Published in the Federal Register.
Objective	a concise statement of what we want to achieve, how much we want to achieve, when and where we want to achieve it, and who is responsible for the work. Objectives derive from goals and provide the basis for determining strategies, monitoring refuge accomplishments, and evaluating the success of strategies. Make objectives attainable, time-specific, and measurable.
occurrence site	a discrete area where a population of a rare species lives or a rare plant community type grows.
old field	an area that was formerly cultivated or grazed and where woody vegetation has begun to invade. If left undisturbed, it will eventually succeed into a forest.
Partners for Fish and Wildlife Program	a voluntary habitat restoration program undertaken by the Fish and Wildlife Service in cooperation with other governmental agencies, public and private organizations, and private landowners to improve and protect fish and wildlife habitat on private lands while leaving the land in private ownership.
Partnership	a contract or agreement entered into by two or more individuals, groups of individuals, organizations or agencies in which each agrees to furnish a part of the capital or some in–kind service, i.e., labor, for a mutually beneficial enterprise.

planning area	a planning area may include lands outside existing planning unit boundaries that are being studied for inclusion in the unit and/or partnership planning efforts. It may also include watersheds or ecosystems that affect the planning area.
planning team	a planning team prepares the comprehensive conservation plan. Planning teams are interdisciplinary in membership and function. A team generally consists of a planning team leader; refuge manager and staff biologist; staff specialists or other representatives of Service programs, ecosystems or regional offices; and state partnering wildlife agencies as appropriate.
population monitoring	assessments of the characteristics of populations to ascertain their status and establish trends related to their abundance, condition, distribution, or other characteristics.
preferred alternative	this is the alternative determined by the decision maker to best achieve the refuge purpose, vision, and goals; contributes to the refuge system mission, addresses the identified issues; and is consistent with principles of sound fish and wildlife management.
prescribed fire	the application of fire to wildland fuels to achieve identified land use objectives (Service Manual 621 FW 1.7), either from natural or intentional ignition.
priority public uses	see wildlife-dependant recreational uses.
private land	land that is owned by a private individual, group of individuals, or non– governmental organization.
private landowner	any individual, group of individuals or non–governmental organization that owns land.
private organization	any non–governmental organization.
Proposed Action	activities for which an Environmental Assessment is being written; the alternative containing the actions and strategies recommended by the planning team. The proposed action is, for all practical purposes, the draft CCP for the refuge.
Protection	mechanisms such as fee title acquisition, conservation easements or binding agreements with landowners that ensure land use and land management practices will remain compatible with maintenance of the species population at the site.

Public	individuals, organizations, and groups; officials of Federal, State, and local government agencies; Indian tribes; and foreign nations. It may include anyone outside the core planning team. It includes those who may or may not have indicated an interest in the Service issues and those who do or do not realize that Service decisions may affect them.
public involvement	a process that offers impacted and interested individuals and organizations an opportunity to become informed about, and to express their opinions on Service actions and policies. In the process, these views are studied thoroughly and thoughtful consideration of public views is given in shaping decisions for refuge management.
public land	land that is owned by the local, state, or Federal government.
purpose of the refuge	the purpose of the refuge is specified in or derived from the law, proclamation, Executive Order, agreement, public land order, donation document, or administrative memorandum establishing, authorizing, or expanding a refuge and refuge unit.
rare species	species identified in Appendix 3–6 as Species of Special Emphasis due to their uncommon occurrence within the watershed.
rare community types	plant community types classified as rare by any of the four state Natural Heritage Programs. As used in this environmental impact statement, is inclusive of the exemplary community types. The types are listed in Appendix 3-4.
Record of Decision (ROD)	a concise public record of decision prepared by the Federal agency, pursuant to NEPA, that contains a statement of the decision, identification of all alternatives considered, identification of the environmentally preferable alternative, a statement as to whether all practical means to avoid or minimize environmental harm from the alternative selected have been adopted (and if not, why they were not), and a summary of monitoring and enforcement where applicable for any mitigation (CFR 1505.2).
refuge goals	descriptive, open-ended and often broad statements of desired future conditions that convey a purpose but do not define measurable units (Writing Refuge Management Goals and Objectives: A Handbook).

refuge purposes	the purposes specified in or derived from the law, proclamation, executive order, agreement, public land order, donation document, or administrative memorandum establishing, authorizing, or expanding a refuge, a refuge unit, or refuge subunit, and any subsequent modification of the original establishing authority for additional conservation purposes (Service Manual 602 FW 1.4).
refuge lands	those lands in which the Service holds full interest in fee title, or partial interest such as easements.
Refuge Operating Needs System (RONS)	the Refuge Operating Needs System is a national database which contains the unfunded operational needs of each refuge. We include projects required to implement approved plans, and meet goals, objectives, and legal mandates.
Restoration	the artificial manipulation of a habitat to restore it to something close to its natural state. Involves taking a degraded grassland and re-establishing habitat for native plants and animals. Restoration usually involves the planting of native grasses and forbs, and may include shrub removal and prescribed burning.
Runoff	water from rain, melted snow, or agricultural or landscape irrigation that flows over the land surface into a water body.
seral forest	a forest in the mature stage of development, usually dominated by large, old trees.
Service presence	the existence of the Service through its programs and facilities which it directs or shares with other organizations; the public awareness of the Service as a sole or cooperative provider of programs and facilities.
Sink	a habitat in which local mortality exceeds local reproductive success for a given species.
sink population	a population in a low-quality habitat in which birth rate is generally less than the death rate and population density is maintained by immigrants from source populations.
Source	a habitat in which local reproductive success exceeds local mortality for a given species.
source population	a population in a high-quality habitat in which birth rate greatly exceeds death rate and the excess individuals leave as migrants.

species of concern	Species present in the watershed for whom the refuge has a special management interest. The following criteria were used to identify “species of concern”: 1. Federally listed as threatened or endangered; 2. migratory bird, especially declining species, Neotropical migrants, colonial waterbirds, shorebirds, or waterfowl; 3. marine mammal; 4. sea turtle; 5. interjurisdictional fish; 6. State-listed as threatened, endangered, or special concern..
state land	public land owned by a state such as state parks or state wildlife management areas.
step-down management plans	step-down management plans describe management strategies and implementation schedules. Step-down management plans are a series of plans dealing with specific management subjects (e.g., croplands, wilderness, and fire) (Service Manual 602 FW 1.4).
stopover habitat	habitat used during bird migration for rest and feeding.
Strategy	a specific action, tool, technique, or combination of actions, tools, and techniques used to meet unit objectives.
threatened species	a federally protected species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.
Tributary	a stream or river that flows into a larger stream, river or lake.

trust resource	one that through law or administrative act is held in trust for the people by the government. A federal trust resource is one for which trust responsibility is given in part to the federal government through federal legislation or administrative act. Generally, federal trust resources are those considered to be of national or international importance no matter where they occur, such as endangered species and species such as migratory birds and fish that regularly move across state lines. In addition to species, trust resources include cultural resources protected through federal historic preservation laws, nationally important and threatened habitats, notably wetlands, navigable waters, and public lands such as state parks and national wildlife refuges.
trust species	see federal trust species.
Understory	any vegetation with canopy below or closer to the ground than canopies of other plants.
unfragmented habitat	large blocks of unbroken habitat of a particular type.
unit objective	desired conditions which must be accomplished to realize a desired outcome. Objectives are the basis for determining management strategies, monitoring refuge accomplishments, and measuring the success of the strategies. Objectives should be attainable and time-specific and may be stated quantitatively or qualitatively (Service Manual 602 FW 1.4).
universally accessible	a universally accessible recreation site is designed to accommodate people with physical disabilities. Interpretive materials at such a sight would be accessible to the visually impaired.
upland	dry ground; other than wetlands.
U.S. Fish and Wildlife Service Mission	our mission is to work with others to “conserve, protect, and enhance fish and wildlife, and their habitat for the continuing benefit of the American people.”
vernal pool	depressions holding water for a temporary period in the spring and used by a variety of amphibians for egg laying.
vision statement	concise statement of what the unit could be in the next 10 to 15 years (Region 7 Planning Staff).

visitor center	a permanently staffed building offering exhibits and interpretive information to the visiting public. Some visitor centers are co-located with refuge offices, other include additional facilities such as classrooms or wildlife viewing areas.
visitor contact station	compared to a visitor center, a contact station is a smaller facility which may not be permanently staffed.
watchable wildlife	all wildlife is watchable. A watchable wildlife program is a strategy to help maintain viable populations of all native fish and wildlife species by building an effective, well– informed constituency for conservation. Watchable wildlife programs are tools by which wildlife conservation goals can be met while at the same time fulfilling public demand for wildlife recreational activities (other than sport hunting, trapping or sport fishing).
Watershed	the geographic area within which water drains into a particular river, stream or body of water. A watershed includes both the land and the body of water into which the land drains.
wet meadow	meadows located in moist low-lying areas, most often dominated by large colonies of reed canary grass. They are often created by collapsed beaver dams and exposed old pond bottoms. Salt marsh meadows are subject to daily coastal tides.
Wetlands	The Fish and Wildlife Service's definition of wetlands states that "Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water." (Cowardin et al., 1979)
Wilderness	The legal definition is found in the Wilderness Act of 1964 Section 2c (P.L. 88-577): “A wilderness, in contrast with those areas where man and his own works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain.” This legal definition places wilderness on the “untrammeled” or “primeval” end of the environmental modification spectrum. Wilderness is roadless lands, legally classified as component areas of the National Wilderness Preservation System, and managed so as to protect its qualities of naturalness, solitude and opportunity for primitive types of recreation (Hendee 1990).

wilderness management	Government and citizen activity to identify–within the constraints of the Wilderness Act–goals and objectives for classified wildernesses and the planning, implementation, and administration of policies and management actions to achieve them. Involves the application of guidelines and principles to achieve established goals and objectives, including management of human use and influences to preserve naturalness and solitude (Hendee 1990).
wildlife corridor	a landscape feature that facilitates the biologically effective transport of animals between larger patches of habitat dedicated to conservation functions. Such corridors may facilitate several kinds of traffic, including frequent foraging movement, seasonal migration, or the once in a lifetime dispersal of juvenile animals. These are transition habitats and need not contain all the habitat elements required by migrants for long-term survival or reproduction.
wildlife-dependent recreational use	"A use of a refuge involving hunting, fishing, wildlife observation and photography, or environmental education and interpretation." These are the six priority public uses of the System as established in the National Wildlife Refuge System Administration Act, as amended. Wildlife-dependent recreational uses, other than the six priority public uses, are those that depend on the presence of wildlife. We also will consider these other uses in the preparation of refuge CCPs, however, the six priority public uses always will take precedence.
wildlife management	the practice of manipulating wildlife populations, either directly through regulating the numbers, ages, and sex ratios harvested, or indirectly by providing favorable habitat conditions and alleviating limiting factors.

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Appendix III. Relevant Legal Mandates

Americans With Disabilities Act (1992): Prohibits discrimination in public accommodations and services.

Antiquities Act (16 U.S.C. 431 - 433): The Act of June 8, 1906, (34 Stat. 225) authorizes the President to designate as National Monuments objects or areas of historic or scientific interest on lands owned or controlled by the United States. The Act required that a permit be obtained for examination of ruins, excavation of archaeological sites and the gathering of objects of antiquity on lands under the jurisdiction of the Secretaries of Interior, Agriculture, and Army, and provided penalties for violations.

Archeological and Historic Preservation Act (16 U.S.C. 469-469c): Public Law 86-523, approved June 27, 1960, (74 Stat. 220) as amended by Public Law 93-291, approved May 24, 1974, (88 Stat. 174) to carry out the policy established by the Historic Sites Act (see below), directed Federal agencies to notify the Secretary of the Interior whenever they find a Federal or Federally assisted, licensed or permitted project may cause loss or destruction of significant scientific, prehistoric or archaeologic data. The Act authorized use of appropriated, donated, and/or transferred funds for the recovery, protection and preservation of such data.

Archaeological Resources Protection Act (16 U.S.C. 470aa - 470ll): Public Law 96-95, approved October 31, 1979, (93 Stat. 721) largely supplanted the resource protection provisions of the Antiquities Act for archaeological items.

This Act established detailed requirements for issuance of permits for any excavation for or removal of archaeological resources from Federal or Indian lands. It also established civil and criminal penalties for the unauthorized excavation, removal, or damage of any such resources; for any trafficking in such resources removed from Federal or Indian land in violation of any provision of Federal law; and for interstate and foreign commerce in such resources acquired, transported or received in violation of any State or local law.

Architectural Barriers Act (1968): Requires federally owned, leased, or funded buildings and facilities to be accessible to persons with disabilities.

Bald Eagle Act of 1940 (16 U.S.C. 668-668d; 54 Stat. 250; 50 CFR Subchapter), as amended. Provides for protection of the bald eagle (the national emblem) and the golden eagle.

Clean Water Act (1977): Requires consultation with the U.S. Army Corps of Engineers for major wetland modifications.

Criminal Code of Provisions of 1940 as amended, (18 U.S.C. 41).
States the intent of Congress to protect all wildlife within federal sanctuaries, refuges, fish hatcheries, and breeding grounds. Provides that anyone (except in compliance with rules and regulations promulgated by authority of law) who hunts, traps, or willfully disturbs any such wildlife, or willfully injures, molest, or destroys any property of the United States on such land or water, shall be fined up to $500 or imprisoned for not more than 6 months or both.

Emergency Wetland Resources Act of 1986
This Act authorized the purchase of wetlands from Land and Water Conservation Fund moneys, removing a prior prohibition on such acquisitions. The Act also requires the Secretary to establish a National Wetlands Priority Conservation Plan, requires the States to include wetlands in their Comprehensive Outdoor Recreation Plans, and transfers to the Migratory Bird Conservation Fund amount equal to import duties on arms and ammunition.

Endangered Species Act of 1973 and recent amendments (16 U.S.C. 1531-1544, 87 Stat. 884), as amended. (Establishing legislation.)
Public Law 93-205, approved December 28, 1973, repealed the Endangered Species Conservation Act of December 5, 1969 (P.L. 91-135, 83 Stat. 275). The 1969 act had amended the Endangered Species Preservation Act of October 15, 1966 (P.L. 89-669, 80 Stat. 926).
The 1973 Endangered Species Act provided for the conservation of ecosystems upon which threatened and endangered species of fish, wildlife, and plants depend, both through Federal action and by encouraging the establishment of State programs. The Act:

- Authorizes the determination and listing of species as endangered and threatened;
- Prohibits unauthorized taking, possession, sale, and transport of endangered species;
- Provides authority to acquire land for the conservation of listed species, using land and water conservation funds;
- Authorizes establishment of cooperative agreements and grants-in-aid to States that establish and maintain active and adequate programs for endangered and threatened wildlife and plants;
- Authorizes the assessment of civil and criminal penalties for violating the Act or regulations; and
- Authorizes the payment of rewards to anyone furnishing information leading to arrest and conviction for any violation of the Act of any regulation issued thereunder.

Environmental Education Act of 1990 (20 U.S.C. 5501-5510; 104 Stat. 3325)
Public Law 101-619, signed November 16, 1990, established the Office of Environmental Education within the Environmental Protection Agency to develop and administer a Federal environmental education program.

Responsibilities of the Office include developing and supporting programs to improve understanding of the natural and developed environment, and the relationships between humans and their environment; supporting the dissemination of educational materials; developing and supporting training programs and environmental education seminars; managing a Federal grant program; and administering an environmental internship and fellowship program. The Office is required to develop and support environmental programs in consultation with other Federal natural resource management agencies, including the Fish and Wildlife Service.

Executive Order 11988 Floodplain Management
The purpose of this Executive Order, signed May 24, 1977, is to prevent Federal agencies from contributing to the "adverse impacts associated with occupancy and modification of floodplains" and the "direct or indirect support of floodplain development." In the course of fulfilling their respective authorities, Federal agencies "shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains.

Executive Order 12996 Management and General Public Use of the National Wildlife Refuge System (1996): Defines the mission, purpose, and priority public uses of the National Wildlife Refuge System. It also presents four principles to guide management of the system.

Executive Order 13007 Indian Sacred Sites (1996): Directs federal land management agencies to accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners, avoid adversely affecting the physical integrity of such sacred sites, and where appropriate, maintain the confidentiality of sacred sites.

Federal Noxious Weed Act (1990): Requires the use of integrated management systems to control or contain undesirable plant species; and an interdisciplinary approach with the cooperation of other federal and state agencies.

Fish and Wildlife Act of 1956 (70 Stat. 1119; 16 U.S.C. 742a-742J), as amended.
Establishes a comprehensive fish and wildlife policy and directs the Secretary of the Interior to provide continuing research; extension and conservation of fish and wildlife resources.

Fish and Wildlife Conservation Act of 1980 (Public Law 96-366, September 29, 1980, 16 U.S.C. §§ 2901-2911, as amended 1986, 1988, 1990 and 1992)
Created a mechanism for federal matching funding of the development of state conservation plans for non-game fish and wildlife. Subsequent amendments to this law require that the Secretary monitor and assess migratory nongame birds, determine the effects of environmental changes and human activities, identify birds likely to be candidates for endangered species listing, and identify conservation actions that would prevent this from being necessary. I 1989, Congress also directed the Secretary to identify lands and waters in the Western Hemisphere, the protection, management or acquisition of which would foster conservation of migratory nongame birds. All of these activities are intended to assist the Secretary in fulfilling the Secretary's responsibilities under the Migratory Bird Treaty Act and the Migratory Bird conservation Act, and provisions of the Endangered Species Act implementing the Convention on Nature Protection and Wildlife Preservation in the Western Hemisphere.

Fish and Wildlife Improvement Act of 1978: This act was passed to improve the administration of fish and wildlife programs and amends several earlier laws, including the Refuge Recreation Act, the National Wildlife Refuge Administration Act, and the Fish and Wildlife Act of 1956. It authorizes the Secretary to accept gifts and bequests of real and personal property on behalf of the United States. It also authorizes the use of volunteers on Service projects and appropriations to carry out volunteer programs.

Historic Sites, Buildings and Antiquities Act (16 U.S.C. 461-462, 464-467): The Act of August 21, 1935, (49 Stat. 666) popularly known as the Historic Sites Act, as amended by Public Law 89-249, approved October 9, 1965, (79 Stat. 971) declared it a national policy to preserve historic sites and objects of national significance, including those located on refuges. It provided procedures for designation, acquisition, administration and protection of such sites. Among other things, National Historic and Natural Landmarks are designated under authority of this Act. As of January, 1989, 31 national wildlife refuges contained such sites.

Land and Water Conservation Fund Act (LWCFA) of 1965: Provides funds from leasing bonuses, production royalties and rental revenues for offshore oil, gas, and sulphur extraction to the Bureau of Land Management, the U.S. Forest Service and the U.S. Fish and Wildlife Service, and State and local agencies for purchase of lands for parks, open space, and outdoor recreation.

Migratory Bird Conservation Act of 1929 (16 U.S.C. 715-715d, 715e,715f-715r)
This Act established the Migratory Bird Conservation Commission which consists of the Secretaries of the Interior (chairman), Agriculture, and Transportation, two members from the House of Representatives, and an ex-officio member from the state in which a project is located. The Commission approves acquisition of land and water, or interests therein, and sets the priorities for acquisition of lands by the Secretary for sanctuaries or for other management purposes. Under this Act, to acquire lands, or interests therein, the state concerned must consent to such acquisition by legislation. Such legislation has been enacted by most states.

Migratory Bird Conservation Act of 1929 (16 U.S.C. 715-s, 45 Stat. 1222), as amended:
Authorizes acquisition, development, and maintenance of migratory bird refuges; cooperation with other agencies, in conservation; and investigations and publications on North American birds. Authorizes payment of 25 percent of net receipts from administration of national wildlife refuges to the country or counties in which such refuges are located.

Migratory Bird Hunting Stamp Act of 1934 (16 U.S.C. 718-718h; 48 Stat. 51), as amended:
Requires that all waterfowl hunters, sixteen (16) years of age or older, possess a valid duck stamp. Net revenues from the sale of duck stamps are used to acquire migratory bird refuges and waterfowl production areas.

Migratory Bird Treaty Act of 1918 (16 U.S.C. 703-711; 50 CFR Subchapter B), as amended:
Implements treaties with Great Britain (for Canada) and Mexico for protection of migratory birds whose welfare is a federal responsibility. Provides for regulations to control taking, possession, selling, transporting, and importing of migratory birds and provides penalties for violations.

National Environmental Policy Act of 1969 (P.L. 91-190, 42 U.S.C. 4321-4347, January 1, 1970, 83 Stat. 852) as amended by P.L. 94-52, July 3, 1975, 89 Stat. 258, and P.L. 94-83, August 9, 1975, 89 Stat. 424). Declares national policy to encourage a productive and enjoyable harmony between humans and their environment. Section 102 of that Act directs that “to the fullest extent possible:

- the policies, regulations, and public laws of the United States shall be interpreted and administered in accordance with the policies set forth in this Act, and

- all agencies of the Federal Government shall...insure that presently unquantified environmental amenities and values may be given appropriate consideration in decision making along with economic technical considerations...”

Section 102(2)c of NEPA requires all federal agencies, with respect to major federal actions significantly affecting the quality the quality of the human environment, to submit to the Council on environmental Quality a detailed statement of:

- The environmental impact of the proposed action;
- Any adverse environmental effect which cannot be avoided should the proposal be implemented;
- Alternatives to the proposed action;
- The relationship between local short-term uses of the environment and the maintenance and enhancement of long-term productivity; and
- Any irreversible and irretrievable commitments of resources which would be involved in the proposed action, should it be implemented.

National Wildlife Refuge System Administration Act of 1966 (Public Law 89-669; 80 Stat. 929; 16 U.S.C. 668dd-668ee), as amended.
This Act defines the National Wildlife Refuge System as including wildlife refuges, areas for protection and conservation of fish and wildlife which are threatened with extinction, wildlife ranges, game ranges, wildlife management areas, and waterfowl production areas. The Secretary is authorized to permit any use of an area provided such use is compatible with the major purposes for which such area was established. The purchase consideration for rights-of-way go into the Migratory Bird Conservation Fund for the acquisition of lands. By regulation, up to 40% of an area acquired for a migratory bird sanctuary may be opened to migratory bird hunting unless the Secretary finds that the taking of any species of migratory game birds in more than 40% of such area would be beneficial to the species. The Act requires an Act of Congress for the divestiture of lands in the system, except (1) lands acquired with Migratory Bird Conservation Commission funds, and (2) lands can be removed from the system by land exchange, or if brought into the system by a cooperative agreement, then pursuant to the terms of the agreement.

National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57, October 9, 1997, Amendment to the National Wildlife Refuge System Administration Act of 1966).
This act defines the mission of the National Wildlife Refuge System:

To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

Key provisions include the following:

- a requirement that the Secretary of the Interior ensures maintenance of the biological integrity, diversity, and environmental health of the National Wildlife Refuge System;
- the definition of compatible wildlife-dependent recreation as “legitimate and appropriate general public use of the [National Wildlife Refuge] System;”

- the establishment of hunting, fishing, wildlife observation and photography, and environmental education and interpretation as “priority public uses” where compatible with the mission and purpose of individual national wildlife refuges;

- the refuge managers’ authority to use sound professional judgment in determining which public uses are compatible on national wildlife refuge an whether or not they will be allowed (a formal process for determining “compatible use” is currently being developed); and

- the requirement of open public involvement in decisions to allow new uses of national wildlife refuges and renew existing ones, as well as in the development of Comprehensive conservation Plans for National Wildlife Refuges.

North American Wetlands Conservation Act (103 Stat. 1968; 16 U.S.C. 4401-4412)
Public Law 101-233, enacted December 13, 1989, provides funding and administrative direction for implementation of the North American Waterfowl Management Plan and the Tripartite Agreement on wetlands between Canada, U.S. and Mexico.

The Act converts the Pittman-Robertson account into a trust fund, with the interest available without appropriation through the year 2006 to carry out the programs authorized by the Act, along with an authorization for annual appropriation of $15 million plus an amount equal to the fines and forfeitures collected under the Migratory Bird Treaty Act.

Available funds may be expended, upon approval of the Migratory Bird Conservation Commission, for payment of not to exceed 50 percent of the United States share of the cost of wetlands conservation projects in Canada, Mexico, or the United States (or 100 percent of the cost of projects on Federal lands). At least 50 percent and no more than 70 percent of the funds received are to go to Canada and Mexico each year.

National and Community Service Act of 1990 (42 U.S.C. 12401; 104 Stat. 3127)
Public Law 101-610, signed November 16, 1990, authorizes several programs to engage citizens of the U.S. in full- and/or part-time projects designed to combat illiteracy and poverty, provide job skills, enhance educational skills, and fulfill environmental needs. Several provisions are of particular interest to the U.S. Fish and Wildlife Service.

American Conservation and Youth Service Corps – As a Federal grant program established under Subtitle C of the law, the Corps offers an opportunity for young adults between the ages of 16-25, or in the case of summer programs, 15-21, to engage in approved human and natural resources projects which benefit the public or are carried out on Federal or Indian lands.

To be eligible for assistance, natural resources programs will focus on improvement of wildlife habitat and recreational areas, fish culture, fishery assistance, erosion, wetlands protection, pollution control and similar projects. A stipend of not more than 100 percent of the poverty level will be paid to participants. A Commission established to administer the Youth Service Corps will make grants to States, the Secretaries of Agriculture and Interior and the Director of ACTION to carry out these responsibilities.

National and Community Service Act – Will make grants to States for the creation of full-time and/or part-time programs for citizens over 17 years of age. Programs must be designed to fill unmet educational, human, environmental, and public safety needs. Initially, participants will receive post-employment benefits of up to $1000 per year for part-time and $2500 for full-time participants.

National Historic Preservation Act of 1966 (16 U.S.C. 470-470b, 470c-470n): Public Law 89-665, approved October 15, 1966, (80 Stat. 915) and repeatedly amended, provided for preservation of significant historical features (buildings, objects and sites) through a grant-in-aid program to the States. It established a National Register of Historic Places and a program of matching grants under the existing National Trust for Historic Preservation (16 U.S.C. 468-468d).

The Act established an Advisory Council on Historic Preservation, which was made a permanent independent agency in Public Law 94-422, approved September 28, 1976 (90 Stat. 1319). That Act also created the Historic Preservation Fund. Federal agencies are directed to take into account the effects of their actions on items or sites listed or eligible for listing in the National Register.

As of January, 1989, 91 historic sites on national wildlife refuges have been placed on the National Register.

National Historic Preservation Act of 1966 (16 U.S.C. 470-470b, 470c-470n, 80 Stat. 915), as amended: There are various laws for the preservation of historic sites and objects.

National Wildlife Refuge System Administration Act of 1966 (Public Law 89-669; 80 Stat. 929; 16 U.S.C. 668dd-668ee), as amended.
Authorizes the Secretary of the Interior to permit the use of any area within the System for any purpose including, but not limited to, hunting, fishing, public recreation and accommodations, and access whenever he determines that such uses are compatible with the major purposes for which such areas were established. Consolidates authorities for the various categories of areas previously established that are administered by the Secretary of the Interior for conservation of fish and wildlife, including species that are threatened with extinction, all lands, waters, and interests therein administered by the Secretary as wildlife refuges, etc., which are hereby designated as the National Wildlife Refuge System. Provides that the Secretary may authorize hunting and fishing to the extent practicable and consistent with State fish and wildlife laws and regulations.

Public Law 100-588, approved November 3, 1988, (102 Stat. 2983) lowered the threshold value of artifacts triggering the felony provisions of the Act from $5,000 to $500, made attempting to commit an action prohibited by the Act a violation, and required the land managing agencies to establish public awareness programs regarding the value of archaeological resources to the Nation.

Refuge Recreation Act of 1962: This Act authorizes the Secretary of the Interior to administer refuges, hatcheries, and other conservation areas for recreational use, when such uses do not interfere with the area's primary purposes. It authorizes construction and maintenance of recreational facilities and the acquisition of land for incidental fish and wildlife oriented recreational development or protection of natural resources. It also authorizes the charging of fees for public uses.

Refuge Revenue Sharing Act (16 U.S.C. 715s): Section 401 of the Act of June 15, 1935, (49 Stat. 383) provided for payments to counties in lieu of taxes, using revenues derived from the sale of products from refuges.

Public Law 88-523, approved August 30, 1964, (78 Stat. 701) made major revisions by requiring that all revenues received from refuge products, such as animals, timber and minerals, or from leases or other privileges, be deposited in a special Treasury account and net receipts distributed to counties for public schools and roads.

Public Law 93-509, approved December 3, 1974, (88 Stat. 1603) required that moneys remaining in the fund after payments be transferred to the Migratory Bird Conservation Fund for land acquisition under provisions of the Migratory Bird Conservation Act.

Public Law 95-469, approved October 17, 1978, (92 Stat. 1319) expanded the revenue sharing system to include National Fish Hatcheries and Service research stations. It also included in the Refuge Revenue Sharing Fund receipts from the sale of salmonid carcasses. Payments to counties were established as:

- on acquired land, the greatest amount calculated on the basis of 75 cents per acre, three-fourths of one percent of the appraised value, or 25 percent of the net receipts produced from the land; and

- on land withdrawn from the public domain, 25 percent of net receipts and basic payments under Public Law 94-565 (31 U.S.C. 1601-1607, 90 Stat. 2662), payment in lieu of taxes on public lands.

This amendment also authorized appropriations to make up any difference between the amount in the Fund and the amount scheduled for payment in any year. The stipulation that payments be used for schools and roads was removed, but counties were required to pass payments along to other units of local government within the county which suffer losses in revenues due to the establishment of Service areas.

Refuge Revenue Sharing Act of 1978 (Public Law 95-469, October 17, 1978, [amended 16 U.S.C. 715s]; 50 CFR, part 34): Changed the provisions for sharing revenues with counties in a number of ways. It makes revenue sharing applicable to all lands administered by the Service, whereas previously it was applicable only to areas in the National Wildlife Refuge System. The new law makes payments available for any governmental purpose, whereas the old law restricted the use of payments to roads and schools. For lands acquired in fee simple, the new law provides a payment of 75 cents per acre, 3/4 of 1 percent of fair market value or 25 percent of net receipts, whichever is greatest, whereas the old law provided a payment of 3/4 of 1 percent adjustment cost or 25 percent of net receipts, whichever was greater. The new law makes reserve (public domain) lands entitlement lands under Public Law 94-565 (16 U.S.C. 1601-1607, and provides for a payment of 25 percent of net receipts.

The new law authorizes appropriations to make up any shortfall in net receipts, to make payments in the full amount for which counties are eligible. The old law provided that if net receipts were insufficient to make full payment, payment to each county would be reduced proportionality.

Refuge Recreation Act of 1966 (Public Law 87-714; 76 Stat. 653-654; 16 U.S.C. 460k et seq.): Authorizes appropriate, incidental, or secondary recreational use on conservation areas administered by the Secretary of the Interior for fish and wildlife purposes.

Refuge Trespass Act of June 28, 1906 (18 U.S.C. 41; 43 Stat. 98, 18 U.S.C. 145).
Provided first Federal protection for wildlife on national wildlife refuges. This Act made it unlawful to hunt, trap, capture, willfully disturb, or kill any bird or wild animal, or take or destroy the eggs of any such birds, on any lands of the United States set apart or reserved as refuges or breeding grounds for such birds or animals by any law, proclamation, or executive order, except under rules and regulations of the Secretary. The Act also protects government property on such lands.

Refuge Trespass Act of June 25, 1948 (18 U.S.C. 41. Stat 686) – Section 41 of the Criminal code, title 18: Consolidates the penalty provisions of various acts from January 24, 1905 (16 U.S.C. 684-687; 33 Stat. 614), through March 10, 1934 (16 U.S.C. 694-694b; 48 Stat. 400) and restates the intent of Congress to protect all wildlife within Federal sanctuaries, refuges, fish hatcheries and breeding grounds. The Act provides that anyone (except in compliance with rules and regulations promulgated by authority of law) who hunts, traps or willfully disturbs any wildlife on such areas, or willfully injures, molest or destroys any property of the United States on such lands or waters, shall be fined, imprisoned, or both.

Rehabilitation Act of 1973 (29 U.S.C. 794)as amended Title 5 of P.L. 93-112 (87 Stat. 355), signed October 1, 1973, prohibits discrimination on the basis of handicap under any program or activity receiving Federal financial assistance.

Section 401 of the Federal Water Pollution Control Act of 1972 (Public Law 92-500; 86 Stat. 816, 33 U.S.C. 1411) : Requires any applicant for a Federal license or permit to conduct any activity which may result in a discharge into navigable waters to obtain a certification from the state in which the discharge originates or will originate, or, if appropriate, from the interstate water pollution control agency having jurisdiction over navigable waters at the point where the discharge originates or will originate, that the discharge will comply with applicable effluent limitations and water quality standards. A certification obtained for construction of any facility must also pertain to subsequent operation of the facility.

Section 404 of the Federal Water Pollution Control Act of 1972 (Public Law 92-500, 86 Stat. 816): Authorizes the Secretary of the Army, acting through the Chief of Engineers, to issue permits, after notice and opportunity for public hearing, for discharge of dredged or fill material into navigable waters of the United States, including wetlands, at specified disposal sites. Selection of disposal sites will be in accordance with guidelines developed by the Administrator of the Environmental Protection Agency in conjunction with the Secretary of the Army. Furthermore, the Administrator can prohibit or restrict use of any defined area as a disposal site whenever she/he determines, after notice and opportunity for public hearings, that discharge of such materials into such areas will have an unacceptable adverse effect on municipal water supplies, shellfish beds, fishery areas, wildlife, or recreational areas.

Thousand Points of Light – Creates a non-profit Points of Light Foundation to administer programs to encourage citizens and institutions to volunteer in order to solve critical social issues, and to discover new leaders and develop institutions committed to serving others.

Transfer of Certain Real Property for Wildlife Conservation purposes Act of 1948
This Act provides that upon determination by the Administrator of the General Services Administration, real property no longer needed by a Federal agency can be transferred, without reimbursement, to the Secretary of the Interior if the land has particular value for migratory birds, or to a State agency for other wildlife conservation purposes.

Wilderness Act of 1964: Public Law 88-577, approved September 3, 1964, directed the Secretary of the Interior, within 10 years, to review every roadless area of 5,000 or more acres and every roadless island (regardless of size) within National Wildlife Refuge and National Park Systems for inclusion in the National Wilderness Preservation System.

Administration of national wildlife refuges is governed by bills passed by the United States Congress and signed into law by the President of the United States, and by regulations promulgated by the various branches of the government. Following is a brief description of some of the most pertinent laws and statues establishing legal parameters and policy direction for the National Wildlife Refuge System:

Wilderness Preservation and Management (50 CFR 35; 78 Stat. 890; 16 U.S.C. 1131-1136; 43 U.S.C. 1201): Provides procedures for establishing wilderness units under the Wilderness Act of 1964 on units of the National Wildlife Refuge System.

Appendix IV. Refuge Biota

Theodore Roosevelt National wildlife Refuge Complex
Bird List

Seasonal Appearance

F	Fall	September - November
W	Winter	December - February
Sp	Spring	March - May
S	Summer	June - August

Seasonal Abundance

c - common (certain to be seen in suitable habitat)
u - uncommon (present but difficult to find)
o - occasional (seen only a few times in a season)
r - rare (seen at irregular intervals)
* - Breeding

Locations: H - Hillside NWR; **P** - Panther Swamp NWR; **Y** - Yazoo NWR;
V - Vicinity/Off Refuges, **C** - Complex Area (all refuges)

Bird Groups	Location	Seasonal Appearance			
		Sp	S	F	W
Loons					
Common Loon	H			R	R
Grebes					
Pied-billed Grebe	H, P, Y*	C	C	C	C
Horned Grebe	Y				R
Eared Grebe	V				R
Pelicans and Allies					
American White Pelican	C	O		U	O
Double-Crested Cormorant	Y*, P, H	U	U	U	C
Anhinga	H, P, Y*	C	C	C	O
Herons, Egrets and Allies					
American Bittern	C	O		O	O
Least Bittern	Y*	C	C	U	
Great Blue Heron	H*,Y*,P	C	C	C	C
Great Egret	H*,Y*,P	C	C	C	U
Snowy Egret	H*,Y*,P	C	C	C	
Little Blue Heron	H*,Y*,P	C	C	C	O
Tricolored Heron	H, P, Y*		O	O	
Cattle Egret	C*	C	C	C	U
Green-backed Heron	C*	C	C	C	O
Black-crowned Night-Heron	H*, P, Y*	C	C	C	O
Yellow-crowned Night-Heron	C*	U	U	U	O
Ibises, Spoonbill, and Storks					
Glossy Ibis	C	O	O	O	R
White Ibis	C*	C	C	C	O
Roseate Spoonbill	C	R	O	R	
Wood Stork	C		O	O	

Bird Groups	Location	Seasonal Appearance			
		Sp	S	F	W
Waterfowl					
Fulvous Whistling-Duck	Y				R
Black-bellied Whistling Duck	Y	R	R		
Tundra Swan	H, Y				O
Greater White-fronted Goose	C	U		C	C
Snow Goose	C	U		C	C
Ross' Goose	Y			U	U
Canada Goose	C, Y*	U	U	C	U
Wood Duck	C*	C	C	C	C
Green-winged Teal	C	U		C	C
American Black Duck	C	O		O	U
Mallard	C*	C	U	C	C
Northern Pintail	C	O		C	C
Blue-winged Teal	C	C	O	C	U
Cinnamon Teal	C			R	R
Northern Shoveler	C	C		C	C
Gadwall	C	C		C	C
American Wigeon	C	C		C	C
Canvasback	C	O		O	O
Redhead	C			O	O
Ring-necked Duck	C	C		C	C
Greater Scaup	C				O
Lesser Scaup	C	U		C	C
Oldsquaw	V				R
Surf Scoter	V				R
White-winged Scoter	V				R
Common Goldeneye	C				O
Bufflehead	C	C		C	C
Hooded Merganser	C*	C	U	U	C
Common Merganser	C				R
Red-breasted Merganser	P				R
Ruddy Duck	C	U		U	C
Vultures, Hawks and Allies					
Black Vulture	H, P	O	O	O	O
Turkey Vulture	H, P	C	C	C	C
Osprey	C	O		R	O
Mississippi Kite	C*	C	C	U	
Bald Eagle	C, V*	O	O	O	U
Northern Harrier	C	U		U	C
Sharp-shinned Hawk	C	U		U	U

Bird Groups	Location	Seasonal Appearance			
		Sp	S	F	W
Cooper's Hawk	C	U		U	U
Red-shouldered Hawk	C	U		U	U
Broad-winged Hawk	C	U	O	O	
Red-tailed Hawk	C	C	U	C	C
Harlan's Hawk	Y	O		O	O
Golden Eagle	C			R	O
Crested Caracara	H			R	
American Kestrel	C	C	O	C	C
Merlin	C			O	U
Gallinaceous birds					
Wild Turkey	H, P*, Y*	U	U	U	U
Northern Bobwhite	H*, P*	U	U	U	U
Rails, Gallinules and Coots					
King Rail	H, Y	R	R	R	
Sora	H, P, Y	U	O	U	O
Purple Gallinule	Y*	U	C	U	R
Common Moorhen	H*, Y*	C	C	C	U
American Coot	C	C	O	C	C
Sandhill Crane	V	R		R	R
Plovers, Sandpipers and Allies					
Lesser Golden Plover	C	O		O	
Black-bellied Plover	C	O		O	
Semipalmated Plover	C	O	U	U	O
Killdeer	C*	C	C	C	C
Black-necked Stilt	C	O	C	C	
American Avocet	C		O	R	
Greater Yellowlegs	C	C	U	C	O
Lesser Yellowlegs	C	C	C	C	
Solitary Sandpiper	C	C	C	C	
Spotted Sandpiper	C	U	C	U	
Upland Sandpiper	C	O		O	
Marbled Godwit	Y	R			
Sanderling	Y			R	
Semipalmated Sandpiper	C	C	C	C	
Western Sandpiper	C	O	O	O	
Least Sandpiper	C	C	C	C	U
Baird's Sandpiper	H, Y	O		O	
Pectoral Sandpiper	C	O	C	C	
Dunlin	Y	O		U	O
Long-billed Dowitcher	H, Y	U	U	C	

Bird Groups	Location	Seasonal Appearance			
		Sp	S	F	W
Short-billed Dowitcher	H, Y			O	
Common Snipe	C	C		C	C
Wilson's Phalarope	C	O	O	R	
Red-necked Phalarope			R		
American Woodcock	C	U		U	U
Gulls, Terns and Skimmers					
Franklin's Gull	Y			R	
Bonaparte's Gull	Y		R	O	O
Ring-billed Gull	Y	C		C	C
Herring Gull	C	O		U	U
Least Tern	Y	O	O	O	O
Black Tern	Y	R		R	
Pigeons and Doves					
Rock Dove	C*	C	C	C	C
White-winged Dove	V			R	
Mourning Dove	C*	C	C	C	C
Common Ground-Dove	H		O	O	O
Eurasion Collared Dove	C	U	U	U	U
Cuckoos					
Yellow-billed Cuckoo	C*	C	C	O	
Owls					
Barn Owl	Y, H*, P*	O	O	O	O
Eastern Screech-Owl	C*	C	C	C	C
Great Horned Owl	C*	U	U	U	U
Burrowing Owl	V				R
Barred Owl	C*	C	C	C	C
Short-eared Owl	C			R	R
Goatsuckers					
Common Nighthawk	C*	U	U	O	
Chuck-will's-widow	C	O	O		
Whip-poor-will	C	O			
Swifts					
Chimney Swift	C*	U	C	U	
Ruby-throated Hummingbird	C*	U	C	C	
Rufous Hummingbird	C			R	R
Kingfishers					
Belted Kingfisher	C	U	C	C	U
Woodpeckers					
Red-headed Woodpecker	C*	C	C	C	C
Red-bellied Woodpecker	C*	C	C	C	C

Bird Groups	Location	Seasonal Appearance			
		Sp	S	F	W
Yellow-bellied Sapsucker	C	U		U	C
Downy Woodpecker	C*	C	C	C	C
Hairy Woodpecker	C*	U	U	U	U
Northern Flicker	C*	C	U	U	C
Pileated Woodpecker	C*	U	U	U	U
Flycatchers					
Olive-sided Flycatcher	Y	R		R	
Eastern Wood-Pewee	C*	C	C	U	
Yellow-bellied Flycatcher	C			R	
Acadian Flycatcher	C*	U	C	C	
Eastern Phoebe	C	C	U	C	C
Vermilion Flycatcher	Y				R
Great Crested Flycatcher	C*	U	U	U	
Western Kingbird	V			R	
Eastern Kingbird	C*	U	C	C	O
Scissor-tailed Flycatcher	Y			R	
Larks					
Horned Lark	C*	C	U	U	C
Martins and Swallows					
Purple Martin	C*	C	C	C	
Tree Swallow	C	C		C	O
Northern Rough-wing Swallow	C	U	U	U	
Cliff Swallow	V	R	O	O	
Barn Swallow	C*	C	C	C	
Jays and Crows					
Blue Jay	C*	C	C	C	C
American Crow	H*, P, Y	U	U	U	U
Fish Crow	H, P, Y	O	O	O	O
Chickadees and Titmice					
Carolina Chickadee	C*	C	C	C	C
Tufted Titmouse	C*	C	U	C	C
Nuthatches					
Red-breasted Nuthatch	C			O	O
White-breasted Nuthatch	C	R		R	O
Creepers					
Brown Creeper	C			O	U
Wrens					
Bewick’s Wren	Y		R	R	R
House Wren	C	O	O	O	O
Winter Wren	C	U		U	U

Bird Groups	Location	Seasonal Appearance			
		Sp	S	F	W
Carolina Wren	C	C	C	C	C
Sedge Wren	C	O		O	O
Marsh Wren	C	O		O	U
Kinglets and Gnatcatchers					
Golden-crowned Kinglet	C	U		U	C
Ruby-crowned Kinglet	C	U		U	C
Blue-gray Gnatcatcher	C*	U	U	U	O
Bluebirds, Thrushes and Robins					
Eastern Bluebird	C	C	C	C	U
Veery	Y	U		U	
Gray-cheeked Thrush	Y	U		U	
Swainson's Thrush	Y	U		U	
Hermit Thrush	C	U		U	U
Wood Thrush	C*	C	C	U	
American Robin	C*	C	U	C	C
Mockingbirds, Thrashers and Allies					
Gray Catbird	C*	U	U	O	O
Northern Mockingbird	C*	C	C	C	U
Brown Thrasher	C*	C	C	C	U
Pipits					
American Pipit	C	U		U	U
Waxwings					
Cedar Waxwing	C	C		C	C
Shrike					
Loggerhead Shrike	C, Y*	U	U	C	C
Starlings					
European Starling	C*	C	C	C	C
Vireos					
White-eyed Vireo	C*	C	U	U	O
Solitary Vireo	C	O		O	U
Yellow-throated Vireo	C*	O	U	O	
Warbling Vireo	C	R	R		
Philadelphia Vireo	C	O		O	
Red-eyed Vireo	C	C	C	O	
Warblers					
Blue-winged Warbler	C	O		O	
Golden-winged Warbler	C		O	O	
Tennessee Warbler	C	C		U	
Orange-crowned Warbler	C				U
Nashville Warbler	C	U		U	

Bird Groups	Location	Seasonal Appearance			
		Sp	S	F	W
Northern Parula	C*	C	C	U	
Yellow Warbler	C	U		U	
Chestnut-sided Warbler	C	U		U	
Magnolia Warbler	C	C		U	
Black-throated Blue Warbler	C	R		R	
Black-and-white Warbler	C	U		U	U
Yellow-rumped Warbler	C	U		C	C
Black-throated Green Warbler	C	C	U		O
Blackburnian Warbler	C	U		O	
Yellow-throated Warbler	C	U	U	U	
Pine Warbler	C	O			U
Prairie Warbler	V	O		R	
Bay-breasted Warbler	C	U		O	
Blackpoll Warbler	C	U		O	
Cerulean Warbler	C	O			
American Redstart	C	U	O	U	
Prothonotary Warbler	C*	C	C	U	
Worm-eating Warbler	C	O			
Swainson's Warbler	H	O	O		
Ovenbird	C	U		U	
Northern Waterthrush	C	R			
Louisiana Waterthrush	C	U	U	U	
Kentucky Warbler	C*	U	U	U	
Mourning Warbler	V	R		R	
Common Yellowthroat	C*	C	C	U	U
Hooded Warbler	C	U		U	
Wilson's Warbler	C	O		U	
Canada Warbler	C	U		U	
Yellow-breasted Chat	C*	C	C		
Tanager					
Summer Tanager	C*	C	C	C	
Scarlet Tanager	C	U		U	
New World Finches					
Northern Cardinal	C*	C	C	C	C
Rose-breasted Grosbeak	C	U		O	
Blue Grosbeak	H, Y*	U	O		
Indigo Bunting	C*	C	C	C	
Painted Bunting	C*	U	U	U	
Dickcissel	C*	C	C	C	R

Bird Groups	Location	Seasonal Appearance			
		Sp	S	F	W
Sparrows					
Rufous-sided Towhee	C*	C	U	U	C
Spotted Towhee	V				R
American Tree Sparrow	V				R
Chipping Sparrow	C	U		U	U
Field Sparrow	C	U	U	U	U
White-crowned sparrow	C	U	U	U	U
Vesper Sparrow	V	U		U	U
Lark Sparrow	V				R
Savannah Sparrow	C	C		U	C
Grasshopper Sparrow	Y*	U	U	U	U
Henslow's Sparrow	Y	R			
LeConte's Sparrow	Y	O			O
Fox Sparrow	C	U		U	U
Song Sparrow	C	C		C	C
Lincoln's Sparrow	Y	O		O	U
Swamp Sparrow	C	C		C	C
White-throated Sparrow	C	C		C	C
Dark-eyed Junco	C	U		U	C
Lapland Longspur	Y				O
Blackbirds, Grackles, Cowbirds and Orioles					
Bobolink	C	U		O	
Red-winged Blackbird	C*	C	C	C	C
Eastern Meadowlark	C*	C	C	C	C
Rusty Blackbird	C	U		U	C
Brewer's Blackbird	C	U		U	U
Common Grackle	C*	C	C	C	C
Brown-headed Cowbird	C*	C	C	C	C
Orchard Oriole	C*	U	C	U	
Northern Oriole	C*	U	C	U	R
Purple Finch					
Purple Finch	C	U		U	U
House Finch	C	U	U	U	C
Pine Siskin	Y				U
American Goldfinch	C	U		U	C
Evening Grosbeck	Y			R	
Old World Sparrows					
House Sparrow	C*	C	C	C	C

Source: Refuge data Files, 2003

Theodore Roosevelt National wildlife Refuge Complex
Mammal List

O - Within the animal's range and contains suitable habitat
X - Presence has been documented

Common Name	Scientific Name	Yazoo	Panther	Hillside	Morgan	Mathews
ORDER MARSUPIALIA (Marsupials) Family Didelphidae - Opossums						
Opossum	*Didelphis marsupialis*	X	X	X	X	X
ORDER INSECTIVORA (Insectivores) Family Soricidae - Shrews						
Short-tailed shrew	*Blarina brevicauda*	O	O	O	O	O
Least shrew	*Cryptotis parva*	O	O	O	O	O
Eastern Mole	*Scalopus aquaticus*	O	O	O	O	O
ORDER CHIROPTERA (Bats) Family (Various)						
Little brown myotis	*Myotis lucifugus*	O	O	O	O	O
Southeastern myotis	*Myotis austroriparius*	O	O	O	O	O
Silver-haired bat	*Lasionycteris noctivagans*	O	O	O	O	O
Eastern pipistrelle	*Pipistrellus subflavus*	O	O	O	O	O
Big brown bat	*Eptesicus fuscus*	O	O	O	O	O
Red bat	*Lasiurus borealis*	X	O	O	O	O
Seminole bat	*Lasiurus seminolus*	X	O	O	O	O
Hoary bat	*Lasiurus cinereus*	O	O	O	O	O
Evening bat	*Nycticeius humeralis*	O	O	O	O	O
Eastern big-eared bat	*Plecotus rafinesquei*	O	O	O	O	O
Brazilian free-tailed bat	*Tadarida brasiliensis*	O	O	O	O	O

Common Name	Scientific Name	Yazoo	Panther	Hillside	Morgan	Mathews
ORDER EDENTATA Family Dasypodidae – Armadillos						
Nine-banded armadillo	*Dasypus novemcinctus*	X	X	X	X	X
ORDER LAGOMORPHA Family Leporidae – Rabbits and Hares						
Eastern cottontail	*Sylvilagus floridanus*	X	X	X	X	X
Swamp rabbit	*Sylvilagus aquaticus*	X	X	X	X	X
ORDER RODENTIA (Rodents) Family Sciuridae – Squirrels						
Eastern chipmunk	*Tamias sciurus*	X	O	X	X	X
Gray squirrel	*Sciurus carolinensis*	X	X	X	X	X
Fox squirrel	*Sciurus niger*	X	X	X	X	X
Southern flying squirrel	*Glaucomys volans*	X	X	X	X	X
Family Castoridae – Beaver						
Beaver	*Castor canadensis*	X	X	X	X	X
Family Cricetidae – Cricetid Rats and Mice						
Rice rat	*Oryzomys palustris*	X	O	O	O	O
Eastern harvest mouse	*Reithrodontomys humulis*	O	O	O	O	O
White-footed mouse	*Peromyscus leucopus*	O	O	O	O	O
Cotton mouse	*Peromyscus gossypinus*	X	O	O	O	O
Golden mouse	*Peromyscus nuttalli*	O	O	O	O	O
Hispid cotton rat	*Sigmodon hispidus*	X	X	X	X	X
Eastern wood rat	*Neotoma floridana*	X	X	X	X	X
Pine vole	*Microtus pinetorum*	X	O	O	O	O
Muskrat	*Ondatra zibethicus*	X	X	X	X	X
Family Muridae - OldWorld Rats and Mice						
Black rat	*Rattus rattus*	O	O	O	O	O
Norway rat	*Rattus norvegicus*	X	X	X	X	O
House mouse	*Mus musculus*	X	X	X	X	O
Family Capromyidae – Nutrias and Coypus						
Nutria	*Myocastor coypus*	X	X	X	X	X

Common Name	Scientific Name	Yazoo	Panther	Hillside	Morgan	Mathews
ORDER CARNIVORA (Carnivores) Family Ursidae – Bears						
Louisiana black bear	*Ursus americanus louisianensis*	X	X	X	O	O
Family Canidae – Wolves, Dogs and Allies						
Coyote	*Canis latrans*	X	X	X	X	X
Red fox	*Vulpes fulva*	X	X	X	X	X
Gray fox	*Urocyon cinereoargenteus*	X	X	X	X	X
Family Procyonidae – Raccoons and Allies						
Raccoon	*Procyon lotor*	X	X	X	X	X
Family Mustelidae – Weasels, Skunks, and Allies						
Long-tailed weasel	*Mustela frenata*	O	O	X	O	O
Mink	*Mustela vison*	X	X	X	X	X
Eastern spotted skunk	*Spilogale putorius*	X	O	X	X	O
Striped skunk	*Mephitis mephitis*	X	X	X	X	X
River otter	*Lutra canadensis*	X	X	X	X	X
Family Felidae – Cats and Allies						
Bobcat	*Lynx rufus*	X	X	X	X	X
Cougar	*Felis concolor*		X			
ORDER ARTIODACTYLA (Even-toed Ungulates) Family Cervidae - Deer and Allies						
White-tailed deer	*Odocoileus virginiana*	X	X	X	X	X

Source: Refuge Data Files, 2003

Theodore Roosevelt National wildlife Refuge Complex
Reptiles And Amphibians

O - Within the animal's range and contains suitable habitat **X** - Presence has been documented

Common Name	Scientific Name	Yazoo	Panther	Hillside	Morgan	Mathews
American alligator	*Alligator mississippiensis*	X	X	X	X	X
Snapping turtle	*Chelydra serpentina*	X	X	X	X	X
Alligator snapping turtle	*Macroclemmys temmincki*	X	X	X	X	X
Stinkpot	*Sternotherus odoratus*	X	X	X	X	X
Razor-backed musk turtle	*Sternotherus carinatus*	O	O	O	O	O
Mississippi mud turtle	*Kinosternon subrubrum hippocrepis*	X	X	O	O	O
Mississippi map turtle	*Graptemys kohni*	O	O	O	O	O
Quachita map turtle	*Graptemys pseudogeographica ouachitensis*	O	O	O	O	O
Red-eared turtle	*Pseudemys scripta elegans*	X	X	X	X	X
Slider	*Chrysemys concinna heiroglyphica*	X	O	O	O	O
Missouri slider	*Pseudemys floridana hoyi*	O	O	O	O	O
Southern painted turtle	*Chrysemys picta dorsalis*	X	O	O	O	O
Chicken turtle	*Deirochelys reticularia miaria*	O	O	O	O	O
Smooth softshell	*Trionyx muticus*	X	O	X	X	X
Spiny softshell	*Trionyx spinifer sspp.*	O	O	X	O	O
Green anole	*Anolis carolinensis*	X	X	X	X	X
Ground skink	*Scincella laterale*	X	X	X	X	O
Five-lined skink	*Eumeces fasciatus*	O	O	O	O	O
Broad-headed skink	*Eumeces laticeps*	X	X	O	O	O
Southeastern five-lined skink	*Eumeces inexpectatus*			O	O	
Slender glass lizard	*Ophisaurus attenuatus*	X	O	O	O	O
Green water snake	*Nerodia cyclopion cyclopion*	X	X	X	X	X
Diamond-backed water snake	*Nerodia rhombifera rhombifera*	X	X	X	X	X
Yellow-bellied water snake	*Nerodia erythrogaster flavigaster*	X	X	X	X	X
Broad-banded water snake	*Nerodia faciata confluens*	X	X	X	X	X
Graham's water snake	*Nerodia grahami*	X	O	O	O	O
Queen snake	*Nerodia septemerittata*	X	O	O	O	O
Midland brown snake	*Storeria dekayi wrightorum*	X	O	O	O	O

Common Name	Scientific Name	Yazoo	Panther	Hillside	Morgan	Mathews
Red-bellied snake	*Storeria occipitomaculata*	O	O	O	O	O
Eastern garter snake	*Thamnophis sirtalis sirtalis*	X	X	X	X	X
Western ribbon snake	*Thamnophis proximus proximus*	X	X	X	X	X
Smooth earth snake	*Virginia valeriae*	X	O	O	O	O
Rough earth snake	*Virginia striatula*	O	O	O	O	O
Eastern hognose snake	*Heterodon platyrhinos*	X	X	O	O	O
Mississippi ringneck snake	*Diadophis punctatus stictogenys*	X	O	O	O	O
Mud snake	*Farancia abacura*	X	X	X	X	X
Racer	*Coluber constrictor sspp.*	X	X	X	X	X
Rough green snake	*Opheodrys aestivus*	X	X	X	X	X
Rat Snake	*Elaphe obsoleta sspp.*	X	X	X	X	X
Speckled kingsnake	*Lampropeltis getulus holbrooki*	X	X	O	O	O
Red milk snake	*Lampropeltis triangulum syspila*	X	O	O	O	O
Scarlet snake	*Cemophora coccinea*	X	O	O	O	O
Coral snake	*Micrurus fulvius*	O	O	O	O	O
Southern copperhead	*Agkistrodon contortrix contortrix*	X	X	X	X	X
Cottonmouth	*Agkistrodon piscivorus piscivorus*	X	X	X	X	X
Pygmy rattlesnake	*Sistrurus miliarius streckeri*	X	O	O	O	O
Canebrake rattlesnake	*Crotalus horridus atricaudatus*	X	X	X	X	X
Three-toed amphiuma	*Amphiuma tridactylum*	X	O	O	O	O
Lesser siren	*Siren intermedia*	X	O	O	O	O
Mole salamander	*Ambystoma talpoideum*	O	O	O	O	O
Marbled salamander	*Ambystoma opacum*	O	O	O	O	O
Small-mouthed salamander	*Ambystoma texanum*	O	O	O	O	O
Spotted salamander	*Ambystoma maculatum*	O	O	O	O	
Central newt	*Notophthalmus viridescens louisianensis*	X	O	O	O	O
American toad	*Bufo americanus*	X	X	X	X	X
Fowler's toad	*Bufo woodhousei fowleri*	X	O	O	O	O
Southern cricket frog	*Acris gryllus gryllus*	X	O	O	O	O
Northern cricket frog	*Acris crepitans crepitans*	X	X	O	O	O

Common Name	Scientific Name	Yazoo	Panther	Hillside	Morgan	Mathews
Spring peeper	*Hyla crucifer*	X	X	O	O	O
Green treefrog	*Hyla cinerea*	X	X	X	X	X
Barking treefrog	*Hyla gratiosa*	X	O	O	O	O
Gray treefrog	*Hyla versicolor*	O	O	O	O	O
Bird-voiced treefrog	*Hyla avivoca*	O	O	O	O	O
Upland chorus frog	*Pseudacris triseriata feriarum*			O	O	
E. narrow-mouthed toad	*Gastrophryne carolinensis*	O	O	O	O	O
Bull frog	*Rana catesbeiana*	X	X	X	X	X
Bronze/Green frog	*Rana clamitans*	X	O	O	O	O
Southern leopard frog	*Rana utricularia*	X	X	X	X	X
Pickerel frog	*Rana palustris*	X	O	O	O	O
Crawfish frog	*Rana areolata*	O	O	O	O	O

Source: Refuge data files, 2003

Theodore Roosevelt National wildlife Refuge Complex
Fish Species

(known (x) or that may occur)

Common Name	**Scientific Name**	Yazoo	Panther Swamp	Hillside	Morgan Brake	Mathews Brake
Longnose Gar	*Lepisosteus osseus*	X	X	X	X	X
Spotted Gar	*Lepisosteus oculaatus*	X	X	X	X	X
Alligator Gar	*Lepisosteus spatula*	X	X	X	X	X
Shortnose Gar	*Lepisosteus platostomus*	X	X	X	X	X
Paddlefish	*Polyodon spatula*	X	X	X	X	X
Shovelnose Sturgeon	*Scaphirhynchus platorhynchus*	X	X	X	X	X
Bowfin	*Amia calva*	X	X	X	X	X
Channel Catfish	*Ictalurus furcatus*	X	X	X	X	X
Yellow Bullhead	*Ameiurus natalis*	X	X	X	X	X
Flathead Catfish	*Pylodictus olivaris*	X	X	X	X	X
Black Bullhead Catfish	*Ameiurus melas*	X	X	X	X	X
Brown Bullhead Catfish	*Ameiurus nebulosus*	X	X	X	X	X
Blue Catfish	*Ictalurus furcatus*	X	X	X	X	X
Bluegill	*Lepomis macrochirus*	X	X	X	X	X
Redear Sunfish	*Lepomis microlophus*		X	X	X	X
Green Sunfish	*Lepomis cyanellus*	X	X	X	X	X
Orange-spotted sunfish	*Lepomis humilis*	X	X	X	X	X
Red-spotted sunfish	*Lepomis miniatus*	X	X	X	X	X
Bantam Sunfish	*Lepomis Symmetricus*	X	X	X	X	X
Banded Pygmy Sunfish	*Elassoma zonatum*	X	X	X	X	X
Longear Sunfish (Delta Subspecies)	*Lepomis megalotis*	X	X	X	X	X
Longear Sunfish (Loess Hill Subspecies)	*Lepomis megalotis*				X	
Black Crappie	*Pomoxis annularis*	X	X	X	X	X
Warmouth	*Lepomis gulosus*	X	X	X	X	X
Yellow Bass	*Morone mississippiensis*	X	X	X	X	X

Common Name	Scientific Name	Yazoo	Panther SAwamp	Hillside	Morgan Brake	Mathews Brake
Shadow Bass	*Ambloplites ariommus*					
White Bass	*Morone chrysops*	X	X	X	X	X
Striped Bass	*Morone saxatillis*					
Largemouth Bass	*Micropterus salmoides*	X	X	X	X	X
Spotted Bass	*Micropterus punctulatus*				X	
Common Carp (intro.)	*Cyprinus carpio*	X	X	X	X	X
Threadfin Shad	*Dorosoma petenense*	X	X	X	X	X
Gizzard Shad	*Donosoma cepedianum*	X	X	X	X	X
Smallmouth Buffalo	*Ictiobus bubalus*	X	X	X	X	X
Bigmouth Buffalo	*Itiobus cyprinellus*	X	X	X	X	X
Black Buffalo	*Ictiobus niger*	X	X	X	X	X
Blue Sucker	*Cycleptus elongatus*	X	X	X	X	X
Freshwater Drum	*Aplodinotus grunniens*	X	X	X	X	X
Grass Pickerel	*Esox americanus*	X	X	X	X	X
Red Shiner	*Cyprinella lutrensis*				X	
Blacktail Shiner	*Cyprinella venusta*	X	X	X	X	X
Pirate Perch	*Aphredoderus sayanus*	X	X	X	X	X
Golden Killifish	*Fundulus chrysotus*	X	X	X	X	X
Blackstripe Killifish	*Fundulus notatus*	X	X	X	X	X
Blackspotted Killifish	*Fundulus olivaceus*	X	X	X	X	X
Western mosquitofish	*Gambusia affinis*	X	X	X	X	X
Brook Silverside	*Labidesthes sicculus*	X	X	X	X	X
Flier	*Centrarchus macropterus*	X	X	X	X	X
Bluntnose Darter	*Etheostoma chlorosma*	X	X	X	X	X
Slough Darter	*Etheostoma gracile*	X	X	X	X	X
Freshwater Drum	*Aplodinotus grunniens*	X	X	X	X	X

Source: Refuge data files, 2003 and Mike Stigall, Mississippi Museum of Natural Science

Theodore Roosevelt National wildlife Refuge Complex
Plant List

(x) = documented/collected

Family	Genus	Species	Common Name	Yazoo	Panther Swamp	Hillside	Morgan Brake	Matthews Brake
Acanthaceae	Justicia	americana	Water-willow	X				
Acanthaceae	Ruellia	sp.	Wild petunia	X				
Aceraceae	Acer	barbatum	Florida maple				X	
Aceraceae	Acer	negundo	Boxelder	X				
Aceraceae	Acer	rubra	Red maple	X				
Aizoaceae	Mollugo	verticillata	Indian chickweed, carpet weed	X				
Alismataceae	Echinodorus	cordifolius	Erect burhead					
Alismataceae	Echinodorus	rostratus	Creeping burhead					
Alismataceae	Sagittaria	platyphylla	Delta arrow-head, Delta duck potato	X				
Amaranthaceae	Alternathera	philoxeroides	Alligator weed	X				
Amaranthaceae	Amaranthus	sp.	Pigweed	X				
Amarillidaceae	Hymenocallis	occidentalis	Spider lily	X				
Anacardiaceae	Rhus	copallina	Winged sumac	X				
Anacardiaceae	Rhus	glabra	Smooth sumac	X				
Anacardiaceae	Toxicodendron	radicans	Poison ivy	X				
Annonaceae	Asimina	triloba	Pawpaw	X				
Apiaceae	Cynosciadium	digitatum		X				
Apiaceae	Daucus	carota	Queen Anne's lace (natzd)	X				
Apiaceae	Foeniculum	vulgare	Fennel (natzd)	X				
Apiaceae	Hydrocotyle	ranunculoides	Pennywort	X				
Apiaceae	Oxypolis	filiformis	Water dropwort	X				
Apiaceae	Ptilimnium	capillaceum	Bishop weed	X				
Apiaceae	Trepocarpus	aethusae	Trepocarpus	X				
Apocynaceae	Trachelospermum	difforme	Climbing dogbane	X				
Aquifoliaceae	Ilex	decidua	Possum haw, Deciduous holly	X				
Aquifoliaceae	Ilex	opaca	American holly	X				
Araceae	Arisaema	atrorubens	Jack-in-the-pulpit				X	
Araceae	Arisaema	dracontium	Green dragon	X			X	
Arailiaceae	Aralia	spinosa	Hercules club; devil's walking stick	X				
Arecaceae	Sabal	minor	Dwarf palmetto	X				
Asclepiadaceae	Asclepias	spp.	Milkweed	X				
Asteraceae	Achillea	millefolium	Yarrow	X				
Asteraceae	Ambrosia	artemisiifolia	Common ragweed	X				
Asteraceae	Ambrosia	spp.	Ragweed	X				
Asteraceae	Ambrosia	trifida	Giant ragweed	X				
Asteraceae	Aster	spp.	Aster	X				
Asteraceae	Baccharis	halimifolia	Groundsel-tree	X				
Asteraceae	Bidens	tripartita	Beggar ticks	X				
Asteraceae	Eclipta	alba	Yerba De tajo	X				
Asteraceae	Erigeron	annuus	White-top fleabane	X				
Asteraceae	Erigeron	spp.	Fleabane	X				
Asteraceae	Iva	annua	Sumpweed	X				
Asteraceae	Krigia	virginica	Dwarf dandelion	X				
Asteraceae	Pluchea	sp.	Stinkweed	X				
Asteraceae	Rudbeckia	heliopsidis	Black-eyed Susan	X				
Asteraceae	Senecio	glabellus	Butterweed	X				

Family	Genus	Species	Common Name	Yazoo	Panther Swamp	Hillside	Morgan Brake	Matthews Brake
Asteraceae	Senecio	vulgaris	Common grounsel	X				
Asteraceae	Solidago	altissima	Tall golden rod	X				
Asteraceae	Spilanthes	americana	Spilanthes	X				
Asteraceae	Taraxacum	officinale	Common dandelion (natzd)	X				
Asteraceae	Verbesina	virginica	White crown-beard	X				
Asteraceae	Xanthium	strumarium	Cocklebur	X				
Balsaminaceae	Impatiens	capensis	Touch-me-not;jewelweed	X				
Berberidaceae	Podophyllum	peltatum	May-apple	X				
Betulaceae	Carpinus	caroliniana	American hornbeam	X				
Betulaceae	Ostrya	virginiana	Eastern hophornbeam				X	
Bignoniaceae	Bignonia	capreolata	Cross vine	X				
Bignoniaceae	Campsis	radicans	Trumpet creeper	X				
Bignoniaceae	Catalpa	bignonioides	Catalpa (cult)	X				
Boraginaceae	Heliotropium	indicum	Turnsole	X				
Brassicaceae	Arabidopsis	thaliana	Mouse-ear cress (natzd)	X				
Brassicaceae	Capsella	bursa-pastoris	Shepherd's purse (natzd)	X				
Brassicaceae	Draba	verna	Whitlow-grass (natzd)	X				
Brassicaceae	Lepidium	virginicum	Poor man's pepper	X				
Bromeliaceae	Tillandsia	usneoides	Spanish moss	X				
Callitrichaceae	Callitriche	sp.	Water starwort	X				
Campanulaceae	Lobelia	cardinalis	Cardinal flower	X				
Campanulaceae	Specularia	biflora	Venus' looking glass	X				
Caprifoliaceae	Lonicera	japonica	Japanese honeysuckle	X				
Caprifoliaceae	Lonicera	sempervirens	Coral honeysuckle	X				
Caprifoliaceae	Sambucus	canadensis	Elderberry	X				
Caprifoliaceae	Viburnum	rufidulum	Rusty blackhaw				X	
Caryophyllaceae	Cerastium	glomeratum	Mouse-ear chickweed	X				
Caryophyllaceae	Stellaria	media	Chickweed	X				
Ceratophyllacea	Ceratophyllum	demersum	Common coontail	X				
Commelinaceae	Commelina	communis	Dayflower	X				
Convolvulaceae	Convolvulus	arvensis	Bindweed	X				
Convolvulaceae	Cuscuta	sp.	Dodder	X				
Convolvulaceae	Ipomoea	purpurea	Morning glory	X				
Convolvulaceae	Ipomoea	wrightii	Morning glory	X				
Cornaceae	Cornus	drummondii	Rough-leaf dogwood	X				
Cornaceae	Cornus	florida	Flowering dogwood				X	
Cornaceae	Nyssa	aquatica	Swamp tupelo				X	
Cornaceae	Nyssa	sylvatica	Black gum				X	
Cucurbitaceae	Melothria	pendula	Creeping cumcumber	X				
Cupressaceae	Juniperus	virginiana	Eatern red cedar (cult & escap)	X				
Cyperaceae	Carex	crus-corvi	Raven-foot sedge	X				
Cyperaceae	Carex	Fissa	Caric-sedge	X				

Family	Genus	Species	Common Name	Yazoo	Panther Swamp	Hillside	Morgan Brake	Matthews Brake
Cyperaceae	Carex	spp.	Sedge	X				
Cyperaceae	Carex	stipata	Sedge	X				
Cyperaceae	Cyperus	erythrorhizos	Red-rooted sedge	X				
Cyperaceae	Cyperus	esculentus	Yellow nutsedge: chufa	X				
Cyperaceae	Cyperus	odoratus	Flatsedge	X				
Cyperaceae	Cyperus	pseudovegetus	Flatsedge	X				
Cyperaceae	Cyperus	rotundus	Purple nutsedge	X				
Cyperaceae	Eleocharis	obtuse	Blunt spikerush	X				
Cyperaceae	Rhynchospora	corniculata	Beak-rush	X				
Droseraceae	Drosera	sp.	Sundew	X				
Ebenaceae	Diospyros	virginiana	Persimmon	X				
Ericaceae	Vaccinium	arboretum	Tree sparkleberry				X	
Euphorbiaceae	Croton	spp.	Croton	X				
Euphorbiaceae	Euphorbia	corollata	Flowering spurge	X				
Fabaceae	Albizia	julibrissin	Mimosa (escaped)	X				
Fabaceae	Amorpha	georgiana		X				
Fabaceae	Apios	americana	Potato bean; ground nut	X				
Fabaceae	Cassia	fasciculata	Patridge pea	X				
Fabaceae	Cassia	nictitans	Wild sensitive plant	X				
Fabaceae	Cassia	obtusifolia	Sicklepod	X				
Fabaceae	Cassia	occidentalis	Coffee senna	X				
Fabaceae	Centrosema	virginianum	Butterlfy pea	X				
Fabaceae	Cercis	canadensis	Redbud	X				
Fabaceae	Clitoria	mariana	Butterfly pea	X				
Fabaceae	Desmanthus	illnoensis	Prairie mimosa	X				
Fabaceae	Desmodium	tortuosum	Florida beggar weed	X				
Fabaceae	Gleditsia	aquatica	Water locust	X				
Fabaceae	Gleditsia	triacanthos	Honey locust	X				
Fabaceae	Glycine	max	Soybean	X				
Fabaceae	Lathyrus	hirsutus	Winterpeas	X				
Fabaceae	Lespedeza	bicolor	Bicolor lespedeza	X				
Fabaceae	Lespedeza	cuneata	Lespedeza	X				
Fabaceae	Medicago	sativa	Alfalfa	X				
Fabaceae	Phaseolus	sp.	Wild bean	X				
Fabaceae	Pueraria	lobata	Kudzu					
Fabaceae	Robinia	pseudo-acacia	Black locust	X				
Fabaceae	Schrankia	microphylla	Sensitive briar	X				
Fabaceae	Sesbania	exaltata	Hemp sesbania	X				
Fabaceae	Tephrosia	sp.	Goat’s rue	X				
Fabaceae	Trifolium	incarnatum	Crimson clover	X				
Fabaceae	Trifolium	repens	White clover	X				
Fabaceae	Vicia	spp.	Vetch	X				
Fabaceae	Vigna	sinensis	Cowpeas	X				
Fabaceae	Wisteria	spp.	Wisteria	X				
Fagaceae	Cladrastis	kentukea	Yellowwood				X	
Fagaceae	Fagus	grandifolia	American beech				X	
Fagaceae	Quercus	alba	White oak				X	
Fagaceae	Quercus	falcata	Southern red oak	X				
Fagaceae	Quercus	falcata var. pagodaefolia	Cherrybark oak	X				
Fagaceae	Quercus	marilandica	Blackjack oak	X				

Family	Genus	Species	Common Name	Yazoo	Panther Swamp	Hillside	Morgan Brake	Matthews Brake
Fagaceae	Quercus	michauxii	Swamp chestnut oak				X	
Fagaceae	Quercus	nigra	Water oak	X				
Fagaceae	Quercus	nuttallii	Nuttall oak	X				
Fagaceae	Quercus	phellos	Willow oak	X				
Fagaceae	Quercus	rubra	Northern red oak	X				
Fagaceae	Quercus	shumardii	Shumark oak	X				
Fagaceae	Quercus	virginiana	Live oak	X				
Fagaceae	Quercus	falcata	Southern red oak				X	
Fagaceae	Quercus	stellata	Post oak				X	
Geraniaceae	Geranium	dissectum	Cranesbill	X				
Haloragidaceae	Myriophyllum	heterophyllum	Water-milfoil	X				
Hamamelidaceae	Liquidambar	styraciflua	Sweetgum	X				
Hippocastanaceae	Aesculus	pavia	Red buckeye				X	
Iridaceae	Sisyrinchium	spp.	Blue-eyed grass	X				
Juglandaceae	Carya	aquatica	Water hickory	X				
Juglandaceae	Carya	cordiformis	Bitternut hickory	X				
Juglandaceae	Carya	glabra	Pignut hickory				X	
Juglandaceae	Carya	illinoensis	Pecan	X				
Juglandaceae	Carya	leiodermis	Swamp hickory	X				
Juglandaceae	Carya	tomentosa	Mockernut hickory				X	
Juglandaceae	Juglans	nigra	Black walnut (introd. & esc.)	X				
Juncaceae	Juncus	spp.	Rush	X				
Lamiaceae	Lamium	amplexicaule	Henbit	X				
Lauraceae	Sassafras	albidum	Sassafras				X	
Lemnaceae	Lemna	spp.	Duckweed	X				
Lentibulariaceae	Utricularia	spp.	Bladderwort	X				
Liliaceae	Hemerocallis	fulva	Daylily (esc.)	X				
Liliaceae	Smilax	glauca	Greenbriar	X				
Liliaceae	Smilax	rotundifolia	Common greenbriar	X				
Liliaceae	Trilllium	sessile	Wake robin				X	
Loranthaceae	Phoradendron	serotinum	Mistletoe	X				
Lythraceae	Ammania	coccinea	Tooth-cup	X				
Lythraceae	Lagerstroemia	indica	Crepe-myrtle (introd)	X				
Lythraceae	Lythrum	lineare	Loosestrife	X				
Magnoliaceae	Liriodendron	tulipifera	Yellow poplar				X	
Magnoliaceae	Liriodendron	tulipifera	Yellow poplar (introd)	X				
Magnoliaceae	Magnolia	acuminate	Cucumbertree				X	
Magnoliaceae	Magnolia	grandiflora	Southern magnolia	X				
Malvaceae	Hibiscus	spp.	Hibiscus	X				
Malvaceae	Hibiscus	syriacus	Rose of Sharon; althea (introd.)	X				
Malvaceae	Sida	spinosa	Prickly sida	X				
Melastomataceae	Rhexia	spp.	Meadow beauty	X				
Meliaceae	Melia	azedarach	Chinaberry (introd. & esc.)	X				
Menispermaceae	Cocculus	carolinus	Coralbeads	X				
Menispermaceae	Menispermum	canadense	Moonseed	X				
Moraceae	Maclura	pomifera	Osage orange	X			X	
Moraceae	Morus	rubra	Red mulberry	X			X	
Nelumbonaceae	Nelumbo	lutea	American lotus	X				

Family	Genus	Species	Common Name	Yazoo	Panther Swamp	Hillside	Morgan Brake	Matthews Brake
Nymphaceae	Brasenia	schreberi	Water-shield	X				
Nymphaceae	Nuphar	luteum	Yellow pond lily	X				
Nyssaceae	Nyssa	aquatica	Water tupelo; swamp tupelo	X				
Nyssaceae	Nyssa	sylvatica	Black gum	X				
Oleaceae	Forestiera	acuminata	Swamp privet	X				
Oleaceae	Fraxinus	pennyslvanica	Green ash	X				
Oleaceae	Fraxinus	profunda	Pumpkin ash	X				
Oleaceae	Ligustrum	sinense	Privet	X				
Onagraceae	Ludwigia	glandulosa	Cylindric seedbox	X				
Onagraceae	Ludwigia	peploides	Floating seedbox	X				
Onagraceae	Ludwigia	spp.	Water primrose	X				
Onagraceae	Ludwigia	umbrosum	Marsh purslane	X				
Onagraceae	Oenothera	speciosa	Evening primrose	X				
Passifloraceae	Passiflora	incarnata	Passion flower; maypop	X				
Philadelphus	Coronarius	syringa	Mock orange	X				
Phytolaccaceae	Phytolacca	americana	Poke salad; pokeweed	X				
Pinaceae	Pinus	taeda	Loblolly pine				X	
Pinaceae	Pinus	taeda	Loblolly pine (intro. & esc.)	X				
Plantaginaceae	Plantago	spp.	Plantain	X				
Platanaceae	Plantus	occidentalis	Sycamore	X				
Poaceae	Andropogon	virginicus	Broom sedge	X				
Poaceae	Arundinaria	gigantea	Cane	X				
Poaceae	Cynodon	dactylon	Bermudagrass	X				
Poaceae	Echinochloa	colonum	Jungle rice	X				
Poaceae	Echinochloa	crusgalli	Mild millet	X				
Poaceae	Echinochloa	walteri	Walter's millet	X				
Poaceae	Eragrostis	spp.	Lovegrass	X				
Poaceae	Festuca	arundinaceae	Fescue	X				
Poaceae	Leersia	lenticularis	Catchfly grass	X				
Poaceae	Leptochloa	filiformis	Red spangletop	X				
Poaceae	Paspalum	laeve	Paspalum	X				
Poaceae	Paspalum	spp.	Paspalum	X				
Poaceae	Setaria	spp.	Foxtail	X				
Poaceae	Sorghum	halepense	Johnsongrass (introd)	X				
Poaceae	Zizaniopsis	miliacea	Giant cutgrass; water millet; S. wildrice	X				
Polemoniaceae	Phlox	paniculata		X				
Polemoniaceae	Phlox	sp.	Phlox				X	
Polygonaceae	Brunnichia	cirrhosa	Eardrop vine	X				
Polygonaceae	Brunnichia	ovata	Ladies' eardrops; redvine	X				
Polygonaceae	Polygonum	cespitosum	Knotweed	X				
Polygonaceae	Polygonum	hydropiperoides	Swamp smartweed	X				
Polygonaceae	Polygonum	lapathifolium	Smartweed	X				
Polygonaceae	Polygonum	pensylvanicum	Smartweed; pinkweed	X				
Polygonaceae	Polygonum	punctatum	Water smartweed	X				
Polygonaceae	Rumex	crispus	Curly dock	X				

Family	Genus	Species	Common Name	Yazoo	Panther Swamp	Hillside	Morgan Brake	Matthews Brake
Polygonaceae	Rumex	verticillatus	Swamp dock	X				
Polypodiaceae	Adiantum	pedatum	Maidenhair fern				X	
Polypodiaceae	Asplenium	sp.	Spleenwort				X	
Polypodiaceae	Botrychium	virginianum	Rattlesnake fern				X	
Polypodiaceae	Onoclea	sensibilis	Sensitive fern				X	
Polypodiaceae	Polypodium	polypodioides	Resurrection fern				X	
Polypodiaceae	Polystichum	acrosticoides	Christmas fern				X	
Polypodiaceae	Pteridium	aquilinum	Bracken				X	
Polypodiaceae	Thelypteris	hexagonoptera	Broad beech fern				X	
Polypodiaceae	Thelypteris	phegopteris	Northern beech fern				X	
Polypodiaceae	Woodsia	obtusa	Wood fern				X	
Portulacaceae	Portulaca	oleracea	Purslane	X				
Potamogetonaceae	Potamogeton	diversifolius	Pondweed	X				
Potamogetonaceae	Potamogeton	spp.	Pondweed	X				
Primulaceae	Hottonia	inflata	Featherfoil	X				
Ranunculaceae	Clematis	crispa	Leather-flower; blue jasmine	X				
Ranunculaceae	Myosurus	minimus	Mouse-tail	X				
Ranunculaceae	Ranunculus	spp.	Buttercup	X				
Rhamnaceae	Berchemia	scandens	Rattan vine	X				
Rosaceae	Duchesnea	indica	Mock strawberry	X				
Rosaceae	Geum	laciniatum	Rough avens	X				
Rosaceae	Prunus	americana	Wild plum	X				
Rosaceae	Prunus	angustifolia	Multiflora rose	X				
Rosaceae	Prunus	mexicana	Mexican plum				X	
Rosaceae	Prunus	serotina	Black cherry	X				
Rosaceae	Pyrus	communis	Pear (introd.)	X				
Rosaceae	Rubus	argustus	Highbush blackberry	X				
Rosaceae	Rubus	trivialis	Southern dewberry	X				
Rubiaceae	Cephalanthus	occidentalis	Buttonbush; button willow; elbow bush	X				
Rubiaceae	Diodia	virginiana	Diodia	X				
Rubiaceae	Galium	sp.	Bedstraw					
Rubiaceae	Houstonia	caerulea	Bluet	X				
Rubiaceae	Mitchella	repens	Partridge berry	X				
Salicaceae	Populus	deltoids	Eastern cottonwood	X				
Salicaceae	Populus	heterophylla	Swamp cottonwood	X				
Salicaceae	Salix	interior	Sandbar willow	X				
Salicaceae	Salix	nigra	Black willow	X				
Sapindaceae	Cardiospermum	halicababum	Balloon vine	X				
Sapotaceae	Bumelia	lycioides	Buckthorn	X				
Saururaceae	Saururus	cernuus	Lizard's tail	X				
Saxifragaceae	Hamamelis	virginiana	Witch hazel				X	
Saxifragaceae	Hydrangea	sp.	Oakleaf hydrangea				X	
Scrophulariacea	Linaria	canadensis	Toadflax	X				
Scrophulariacea	Pedicularis	canadensis	Lousewort	X				
Scrophulariaceae	Gratiola	brevifloia	Hedge hyssop	X				
Scrophulariaceae	Micranthemum	umbrosum	Shade Mudflower	X				
Solanaceae	Solanum	carolinense	Nightshade	X				
Styracaceae	Styrax	americana	American Snowbell; Storax	X				
Taxodiaceae	Taxodium	distichum	Baldcypress	X				
Tiliaceae	Tilia	caroliniana	Basswood				X	

Family	Genus	Species	Common Name	Yazoo	Panther Swamp	Hillside	Morgan Brake	Matthews Brake
Typhaceae	Typha	latifolia	Cattail	X				
Ulmaceae	Celtis	laevigator	Sugarberry	X				
Ulmaceae	Planera	aquatica	Planer Tree	X				
Ulmaceae	Ulmus	americana	White Or American Elm	X				
Ulmaceae	Ulmus	crassifolia	Cedar Elm	X				
Ulmaceae	Ulmus	rubra	Slippery Elm				X	
Ulmaceae	Ulmus	alata	Winged Elm				X	
Urticaceae	Boehmeria	cylindrica	False Nettle	X				
Urticaceae	Urtica	chamydryoides	Stinging Nettle	X				
Valerianaceae	Valerianella	spp.	Corn Salad	X				
Verbenaceae	Callicarpa	americana	French Mulberry; American Beautyberry	X				
Verbenaceae	Lippia	lanceolata	Northern Frog Fruit	X				
Verbenaceae	Lippa	nodiflora	Frog Fruit	X				
Verbenaceae	Verbena	brasiliensis	Verbena	X				
Violaceae	Viola	emarginata	Triangle-Leaved Violet	X				
Violaceae	Viola	papilionacea	Common Violet; Butterfly Violet	X				
Violaceae	Viola	pedata	Bird-Foot Violet	X				
Violaceae	Viola	tricolor	Wild Pansy, Johnny Jump-Up	X				
Vitaceae	Parthenocissus	quinquefolia	Virginia Creeper	X				
Vitaceae	Vitis	rotundifolia	Muscadine	X				

Source: Refuge data files, 2003

Theodore Roosevelt National Wildlife Refuge Complex
Mussel List

(x) = Mussel surveyed on refuge

Common Name	Scientific Name	Yazoo	Panther Swamp	Hillside	Morgan Brake	Mathews Brake
Threeridge	A. plicata	x	X	x		
Flat Floater	A. suborbiculata	x	X	x		
Rock Pocketbook	A. confragosus	x				
Plain Pocetbook	L. cardium	x				
Yellow Sandshell	L. teres	x	X	x		
Fragile Papershell	L. fragilis	x	X	x		
Pondmussel	U. imbecillis	x		x		
Washboard	M. nervosa	x		x		
Bankclimber	P. dombeyanus	x	X	x		
Pink Papershell	P. ohiensis	x				
Giant Floater	P. grandis	x	X	x		
Wartyback	Q. nodulata	x		x		
Pimpleback	Q. pustulosa	x	X	x		
Mapleleaf	Q. quadrula	x	X	x		
Lilliput	T. parvus	x				
Texas Lilliput	T. texasiensis	x	X	x		
Pistolgrip	T. verrucosa	x		x		
Paper Pondshell	U. imbecillis	x	X	x		
Asian Clam	C. fluminea	x	X	x		
Threehorn Wartyback	O. reflexa		X	x		
Pondhorn	U. tetralasmus		X	x		
Bleufer	P. purpuratus			x		
Deertoe	T. truncata			x		

Source: Mussell Surveys for Yazoo, Panther Swamp and Hillside, NWRs, FWS, Emily Hartfield, 2002.

Appendix V. Compatibility Determinations

Introduction

In accordance with the National Wildlife Refuge System Administration Act of 1966, the Refuge Recreation Act of 1962, and the National Wildlife Refuge System Improvement Act of 1997, the Service may not permit secondary uses on a national wildlife refuge before the uses are determined compatible with the purpose of the Refuge System and individual refuge purposes and mission. Therefore, twelve compatibility determinations were prepared for the Preferred Alternative, Alternative B. These determinations are offered for public review and comment, along with the Draft Comprehensive Conservation Plan for Theodore Roosevelt National Wildlife Refuge Complex.

National Wildlife Refuge System Mission: As outlined in the 1997 National Wildlife Refuge System Improvement Act, the mission of the National Wildlife Refuge System is:

"... to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife and plant resources and their habitats within the United States for the benefit of present and future generations of Americans."

The establishing legislation and refuge purposes (see following Table) for each refuge in the Complex are similar, with a primary mission to manage for migratory birds and fish and wildlife resources. The refuges all lie within the Mississippi Alluvial Valley, in an area known as the Delta. Therefore, habitats are predominantly similar on all seven refuges. The refuges are managed as a system and are made up of the following: **Hillside, Holt Collier, Mathews Brake, Morgan Brake, Panther Swamp, Theodore Roosevelt, and Yazoo**.

The compatibility determinations have been drafted to apply collectively to the following twelve uses, for applicable refuges and Farm Service Agency tracts managed by the Complex.

1. **Commercial Photography**
2. **Cooperative Farming (Hillside, Hillside Expansion Unit, Morgan Brake, Panther Swamp, and Yazoo NWRs)**
3. **Environmental Education**
4. **Interpretation**
5. **Wildlife Observation**
6. **Wildlife Photography**
7. **Firewood Cutting**
8. **Fishing – Recreational, including Frogging (Hillside, Mathews Brake, Morgan Brake, Panther Swamp, and Yazoo NWRs)**
9. **Hunting**
10. **Research**
11. **Timber Harvest for Forest Management**
12. **Trapping**

Refuge	Establishing Legislation	Refuge Purpose
Yazoo Established 1936	Migratory Bird Conservation Act (1929), Migratory Bird Treaty Act (1918)	"...for use as an inviolate sanctuary, or for any other management purposes, for migratory birds..."
Panther Swamp 1978	Migratory Bird Conservation Act (1929), Refuge Recreation Act (1962)	"...for use as an inviolate sanctuary, or for any other management purposes, for migratory birds..." "...suitable for (1) incidental fish and wildlife-oriented recreation development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species..."
Hillside 1975	Fish and Wildlife Coordination Act	"...shall be administered by him (Secretary of Interior) directly or in accordance with cooperative agreements...and in accordance with such rules and regulations for the conservation, maintenance, and management of wildlife resources thereof, and its habitat thereon..."
Morgan Brake 1977	Migratory Bird Conservation Act (1929) Refuge Recreation Act (1962).	"...for use as an inviolate sanctuary, or for any other management purpose, for migratory birds." "...for the development, advancement, management, conservation, and protection of fish and wildlife resources..." "...for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude.."
Mathews Brake 1980	Migratory Bird Conservation Act (1929)	"...to contribute to perpetuation of the migratory waterfowl resource in the lower Mississippi River Delta..."
Theodore Roosevelt 2004	Consolidated Farm and Rural Development Act	"for conservation purposes"
Holt Collier 2004	Consolidated Farm and Rural Development Act; Fish and Wildlife Coordination Act	"for conservation purposes" ". . . conservation, maintenance, and management of wildlife, resources thereof, and its habitat thereon. . ."

Other Applicable Laws, Regulations, and Policies:

Antiquities Act of 1906 (34 Stat. 225)
Migratory Bird Treaty Act of 1918 (15 U.S.C. 703-711; 40 Stat. 755)
Migratory Bird Conservation Act of 1929 (16 U.S.C. 715r; 45 Stat. 1222)
Migratory Bird Hunting Stamp Act of 1934 (16 U.S.C. 718-178h; 48 Stat. 451)
Criminal Code Provisions of 1940 (18 U.S.C. 41)
Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d; 54 Stat. 250)
Refuge Trespass Act of June 25, 1948, (18 U.S.C. 41; 62 Stat. 686)
Fish and Wildlife Act of 1956 (16 U.S.C. 742a-742j; 70 Stat.1119)
Refuge Recreation Act of 1962 (16 U.S.C. 460k-460k-4; 76 Stat. 653)
Wilderness Act (16 U.S.C. 1131; 78 Stat. 890)
Land and Water Conservation Fund Act of 1965
National Historic Preservation Act of 1966, as amended (16 U.S.C. 470, et seq.; 80 Stat. 915)
National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. 668dd, 668ee; 80 Stat. 927)
National Environmental Policy Act of 1969, NEPA (42 U.S.C. 4321, et seq.; 83 Stat. 852)
Use of Off-Road Vehicles on Public Lands (Exec. Order 11644, as amended by E.O. 10989)
Endangered Species Act of 1973 (16 U.S.C. 1531 et seq.; 87 Stat. 884)
Refuge Revenue Sharing Act of 1935, as amended in 1978 (16 U.S.C. 715s; 92 Stat. 1319)
National Wildlife Refuge Regulations for the Most Recent Fiscal Year (50 CFR Subchapter C; 43 CFR 3101.3-3)
Emergency Wetlands Resources Act of 1986 (S.B. 740)
North American Wetlands Conservation Act of 1990
Food Security Act (Farm Bill) of 1990 as amended (HR 2100)
The Property Clause of the U.S. Constitution Article IV 3, Clause 2
The Commerce Clause of the U.S. Constitution Article 1, Section 8
The National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57, USC668dd)
E. O. 12996, Management and General Public Use of the National Wildlife Refuge System, March 25, 1996
Title 50, Code of Federal Regulations, Parts 25-33
Archaeological Resources Protection Act of 1979
Native American Graves Protection and Repatriation Act of 1990

1. Commercial Photography

Refuge: Hillside, Holt Collier, Mathews Brake, Morgan Brake, Panther Swamp, Theodore Roosevelt, and Yazoo NWRs, and Farm Service Agency lands

Description of Use: General public access by commercial photographers to photograph wildlife and refuge habitats for commercial purposes. The use includes access by individual in vehicles on improved roads, by foot or ATV on unimproved roads, and by boat, canoe, or kayak on refuge sloughs, lakes, or other waters. Activities may include vehicular use of roadways normally restricted to foot traffic, or emplacing temporary structures, such as blinds or photography frameworks. Currently, commercial photography occurs at many locations on the refuges, particularly in areas where migratory waterfowl congregate, alligators bask in the sun, or in areas frequented by neotropical migratory birds. However, any location that provides a desired photographic opportunity is accessed. Commercial photography occurs during daylight hours throughout the year.

Availability of Resources: The refuge would normally incur no expense except administrative costs for issuance of a Special Use Permit and staff time to conduct compliance checks.

Anticipated Impacts of the Use: Activities associated with commercial photography have shown no measurable environmental impacts to the refuge, its habitats, or wildlife species. The use can cause temporary minor disturbance to waterfowl due to human proximity, particularly in winter, spring, and during the early summer nesting and brood rearing period. However, random and limited use by the public is expected to be temporary and should not create more than minor disturbance. Any malicious or unreasonable harassment of wildlife would be grounds for the manager to restrict the uses to minimize harm.

Commercial photography can increase visitors' knowledge and appreciation of fish and wildlife on the refuge, and lead to greater understanding of the Refuge System's public stewardship mission. Photographs taken on refuge lands, when provided to refuge staff for outreach and public use program enhancement, complement Service actions and enhance its ability to draw more visitors to the refuge.

Public Review and Comment: This compatibility determination is provided for public review and comment during the DraftComprehensive Conservation Plan comment period.

Determination:
____ Use is Not Compatible
_X_ Use is Compatible with the Following Stipulations

Stipulations Necessary to Ensure Compatibility: The following stipulations are required to ensure compatibility:

a. All commercial photographers must have a Special Use Permit (SUP) that specifies road conditions, times, and routes of access, if necessary, and other conditions to prevent excessive disturbance to wildlife, damage to habitat, or conflicts with other public use or management activities. The SUP will stipulate that imagery produced on Complex lands be made available to the refuge for use in outreach, interpretation, internal documents, or other suitable uses.

b. The commercial photography use must demonstrate a means to extend public appreciation and understanding of wildlife, natural habitats, enhance education, appreciation and/or understanding of the Refuge System, or further outreach and education goals of the refuge.

c. Commercial products must include appropriate credits to the refuge and to the Fish and Wildlife Service.

Justification: When administered by SUP, commercial photography will provide images and related materials that can be used to support refuge outreach goals, enhance outdoor education and interpretation, and increase appreciation and understanding of the Refuge System.

NEPA Compliance for Refuge Use Decision: *Place an X in appropriate space.*

___ Categorical Exclusion without Environmental Action Statement
___ Categorical Exclusion and Environmental Action Statement
_X_ Environmental Assessment and Finding of No Significant Impact
___ Environmental Impact Statement and Record of Decision

2. Cooperative Farming

Refuge: Hillside, Morgan Brake, Panther Swamp, Yazoo NWRs, and agricultural lands on the Hillside Expansion Unit.

Description of Use: Cooperative farming is an arrangement with local farmers that provides refuge land to the farmer in exchange for a portion of the crop. Cooperative farming has long been the most economical method for meeting refuge crop objectives. Certain agricultural crops (e.g., rice, corn, milo, wheat) provide the greatest yield of waterfowl food per unit area, supplementing natural foods that contribute energy, protein, and other nutrients. The agricultural lands are scattered throughout the refuges to maintain a diversity of habitats.

In the cooperative farming program the farmer uses his/her own equipment and fuel to prepare the ground, plant the fields, apply herbicide and pesticide, and harvest a percentage (usually 75 percent) of the crop. The remaining crop (25 percent) is left in the field as food for waterfowl and other wildlife. Cooperative farmers also assist with habitat management (i.e., disk moist-soil management areas to control woody vegetation) and refuge maintenance activities (i.e., mowing roads, repairing roads damaged as result of farming operations, mowing turn-rows, etc.), that help refuges maintain refuge resources.

The Complex partners with approximately nine local farmers to produce crops, on a share basis, on about 6,500 acres of agricultural land on Hillside, the Hillside Expansion Unit, Morgan Brake, Panther Swamp, and Yazoo NWRs. Cooperative farmers are permitted to plant only rice, corn, soybeans, milo, millet, sunflower, winter wheat, and other crops beneficial to wildlife. These crops provide cover, high calorie “hot foods” that supplement natural foods, and yield large amounts of metabolizable energy for geese and certain duck species during the wintering migration season. Winter wheat provides green browse for Canada and white-fronted geese.

The refuge determines where the crops will be left in the field to ensure greatest benefit to waterfowl. Crops taken by farmers generally include rice, corn, soybeans, and winter wheat, while those left for wildlife include rice, corn, milo, and millet. Although the cooperative farming program is intended primarily to provide food for wintering waterfowl, agricultural crops benefit game species as well, including deer, wild turkey, woodcock, and raccoon.

Availability of resources: The cooperative farming program requires an adequate level of staff to ensure that annual agreements are developed and signed, farming activities are monitored to ensure compliance with the annual agreement, and the administrative work associated with the Pesticide Use Permit process is accomplished.

Anticipated Impacts of the Use: The cooperative farming program impacts refuge lands by producing vital food and cover for waterfowl during the wintering season, as well as food and cover for game species such as deer and wild turkey. The farming program also exposes refuge lands to chemicals, increased erosion, and the resultant runoff into refuge lakes, rivers, and wetlands.

Waterfowl expend considerable energy to obtain mates, maintain body temperatures during cold weather, and migrate from area to area in search of food, cover, and water. Therefore, ready availability of food resources during the wintering season is vital for survival.

Farmers use pesticides and herbicides to control pests and weeds that reduce crop yields. The chemicals can have a variety of direct and indirect effects on wildlife. Therefore, the Service requires that chemicals used on refuge lands are approved for use through the annual Pesticide Use Proposal (PUP) process. The process includes application requirements and varying levels of review depending upon the nature of the chemical and how it is applied. The PUP process ensures that relatively safe pesticides are applied to refuge lands and that threatened and endangered species are not adversely affected.

Impacts are reduced and effects on refuge lands minimized through the annual cooperative farming agreement. These agreements are prepared annually with each cooperative farmer. The agreement specifies which crops will be planted, which pesticides have been approved for use on areas they farm, prohibited activities such as applying chemicals aerially without the refuge manager's approval, and best management practices to reduce erosion and surface runoff into refuge lakes, streams, and wetlands. The cooperative farming program is evaluated annually and ongoing monitoring is conducted to ensure that the conditions specified in the Cooperative Farming Agreement are being met and that the overall condition of the area is not being degraded.

Public Review and Comment: This compatibility determination is provided for public review and comment during the DraftComprehensive Conservation Plan comment period.

Determination:
____ Use is Not Compatible
_X_ Use is Compatible with the Following Stipulations

Stipulations Necessary to Ensure Compatibility:

a. Cooperative farmers are required to sign and comply with an annual Cooperative Farming Agreement that specifies which crops will be planted, refuge/farmer share, compliance with the PUP process, Best Management Practices, and other details.

b. Refuge staff will conduct ongoing monitoring on farming activities to ensure that impacts on refuge lands are minimal and that cooperative farmers comply with the annual Cooperative Farming Agreement.

Justification: The cooperative farming program is a critical component of management for migratory waterfowl and supports the objectives of the North American Waterfowl Management Plan by providing food resources and a diversity of wildlife habitat for waterfowl and a suite of additional species. The use is in compliance with the comprehensive conservation plan and furthers the goals and missions of the National Wildlife Refuge System and the Theodore Roosevelt National Wildlife Refuge Complex.

NEPA Compliance for Refuge Use Decision: *Place an X in appropriate space.*

___ Categorical Exclusion without Environmental Action Statement
___ Categorical Exclusion and Environmental Action Statement
_X_ Environmental Assessment and Finding of No Significant Impact
___ Environmental Impact Statement and Record of Decision

3-6. Environmental Education, Interpretation, Wildlife Observation, and Wildlife Photography

Refuge: Hillside, Holt Collier, Mathews Brake, Morgan Brake, Panther Swamp, Theodore Roosevelt, and Yazoo NWRs, and Farm Service Agency lands lands.

Environmental education, interpretation, wildlife observation, and wildlife photography (wildlife-dependent activities) have been identified in the National Wildlife Refuge System Improvement Act of 1997 as priority public uses, provided they are compatible with the purpose for which the refuge was established.

Environmental education, interpretation, wildlife observation and wildlife photography occur during daylight hours throughout the year. Access is by refuge roads, trails, fields, or other ingress and egress points. Refuge roads prohibited to public access, or refuge closed areas are clearly marked with signs. Entry on all or portions of refuge roads and trails may be temporarily suspended by posting upon occasions of unusual or unsafe conditions affecting land, water, vegetation, wildlife populations, or public safety.

Environmental education and interpretation consist of public outreach and onsite activities conducted by refuge staff, volunteers, teachers, Friends Group members, conservation partners, university professors, and others. Interpretation occurs when information is interpreted for the public by refuge staff or others using exhibits, displays, signs, kiosks, facilities, and brochures. Environmental education and interpretation includes activities carried out at refuge observation towers, nature trails, Indian mounds developed for interpretation, refuge areas of interest, the refuge Headquarters Office, and other areas suitable for these uses. Refuge facilities and lands may be used as outdoor classrooms by groups of students with a teacher and a formalized plan of environmental study, by members of organizations such as Girl Scouts or Boy Scouts, or by other members of the public. Educational activities may be conducted in areas and at times approved by the refuge manager. Refuge environmental resources may be used to demonstrate principles of environmental science.

Environmental education and interpretation activities can occur throughout the year, but generally occur mostly in the spring and fall. All environmental education and interpretation activities are conducted with the refuge's primary goals, objectives, and habitat management requirements as the guiding principles. Activities conducted under these restrictions allow the refuge to accomplish its management goals and provide for the safety of visitors.

Wildlife observation and photography occurs on refuge lands where wildlife congregate and the public can see them. General public access to observe or to photograph wildlife and refuge habitats includes driving, hiking, bicycling, or boating. Currently, Yazoo Refuge offers wildlife observation towers at Lizard Lake and Alligator Pond; however, wildlife observation and photography can occur at any location on refuge lands that is not prohibited to public access.

Wildlife observation and photography are allowed wherever and whenever visitor access is allowed throughout the Complex. Visitors must comply with existing laws, regulations, and policies concerning access and harassment of wildlife. Much of the wildlife observation will be done from privately owned vehicles. Observation platforms, boardwalks, trails, and parking areas have been constructed to provide safe, convenient areas for visitors to use. Off-trail use will be allowed, but it will not be concentrated or restricted to a given area. Vehicle use will be restricted to all-weather roads.

Availability of Resources: The current levels of environmental education, interpretation, and wildlife observation and photography require minimal resources. Accessible lands on the refuge have been open to public use for many years, thus, access trails, parking lots, signs, and other facilities, as well as staff to enforce regulations and maintain these facilities, have been provided by the Service. The Comprehensive Conservation Plan recommends some strategies to improve outreach and facilities and to increase visitor use. Full implementation of these strategies will require additional funding and staffing. Funds are currently available to maintain existing programs.

Anticipated Impacts of the Use: Wildlife observation and photography have shown no measurable environmental impacts to the refuge, its habitats, or wildlife species. Access is typically by individuals or small groups in vehicles. Foot travel occurs on refuge roads and trails and produces only temporary disturbance to wildlife. The most likely impact to refuge purposes would be during spring and early summer nesting and brood rearing, and during spring and fall migration. However, the expected sporadic and limited use by the public should not create unreasonable impacts. Winter activities pose no impacts to nesting waterfowl and little impact to vegetation. The winter disturbance to resident wildlife is temporary and minor. Large groups of visitors typically use established foot trails and produce little impact to vegetation. Disturbance to wildlife, such as flushing a nesting bird, is inherent to these activities; however, the disturbance is temporary and generally not malicious. Any unreasonable harassment would be grounds for the manager to close the area to these uses or restrict the uses to minimize harm. Restrictions on refuge road use will assure minimal impacts on priority species and restrict disturbance to wildlife and other public use activities.

Structural damage from vandalism, as well as natural occurrences such as falling limbs or trees, is expected to occur to wildlife observation platforms, boardwalks, facilities, and trails. Maintenance activities to repair damages will ensure public access and minimize damage over time.

Public Review and Comment: This compatibility determination is provided for public review and comment during the DraftComprehensive Conservation Plan comment period.

Determination:
____ Use is Not Compatible
_X_ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility:

a. All wildlife observation and photography activities will be conducted with the refuge's primary objectives, habitat management requirements, and goals as the guiding principles.

b. Modes of access are limited to any legal means on designated refuge roads, public roads, trails, parking lots, and aquatic areas open to the public.

c. Adequate precautions will be taken to ensure that permanent facilities, such as trails, platforms, and boardwalks, are sited an adequate distance from sensitive wildlife areas, such as heron rookeries or eagle nests.

d. Harassment of wildlife and excessive damage to vegetation are prohibited. Wildlife observation facilities located near sensitive areas, such as rookeries, must have adequate signing and supervision to deter harassment or enforce regulations against harassment of wildlife.

e. Refuge staffing must be adequate to provide maintenance and litter control on trails, boardwalks, and platforms.

f. Camping, overnight use, and fires are prohibited.

Justification: Environmental education, interpretation, wildlife observation, and wildlife photography are priority public uses on National Wildlife Refuge System Lands as identified in the Refuge Improvement Act of 1997. By facilitating these uses on the refuge, we will increase visitors' knowledge and appreciation of fish and wildlife, which will lead to increased public stewardship of fish and wildlife and their habitats on the refuge and in general. Increased public stewardship will support and complement the Service's actions in achieving the refuge's purposes and the mission of the National Wildlife Refuge System.

NEPA Compliance for Refuge Use Decision: *Place an X in appropriate space.*

___ Categorical Exclusion without Environmental Action Statement
___ Categorical Exclusion and Environmental Action Statement
_X_ Environmental Assessment and Finding of No Significant Impact
___ Environmental Impact Statement and Record of Decision

7. Firewood Gathering

Refuge: Hillside, Holt Collier, Mathews Brake, Morgan Brake, Panther Swamp, Theodore Roosevelt, and Yazoo NWRs, and Farm Service Agency lands.

Description of Use: Firewood gathering is the cutting and removal of woody material for private use by the individual removing the firewood. Firewood gathering is offered to the public following timber stand improvement or forest thinning in small lots or areas, or at times when timber sales are not feasible. In young tree plantations, firewood gathering could be offered in lieu of a commercial timber harvest operation. It may also be permitted when trees that have fallen across roads, trails, or firebreaks must be removed.

Private individuals are permitted to remove, *for personal use only,* fallen timber or marked standing timber as designated by the refuge manager. The scope of the use will be determined by the management objective for the area and by the quantity and quality of available wood. Harvest sites will vary in size from a portion of an acre up to several hundred acres depending on the site and management objectives. Wood removal activities may be authorized throughout the year when ground conditions allow access without damaging refuge roads and resources.

Chainsaws and axes may be used to harvest firewood. Access may be by car and trailer or pickup truck. Differences in scope and necessary equipment will occur depending on the amount and type of wood available for removal. This activity will only occur where the Service has determined that a management need exists to remove wood.

Availability of Resources: Excess woody material is plentiful on all seven refuges in the Complex. Public firewood gathering requires oversight and administration by the refuge forester, as time allows, or by other staff experienced with the program. Refuge operations and maintenance funding would be needed to cover salaries of staff members who complete paperwork and administer the program, and for marking paint, flagging, vehicles, and fuel.

Anticipated Impacts of the Use: The potential exists to directly impact wildlife by displacing animals from localized areas due to disturbance, noise, or removal of nesting areas. Due to the small scale of firewood gathering on the Complex, disturbance to wildlife would be negligible. Avoidance of nesting periods for migratory birds would reduce impacts on populations. Most impacts can easily be avoided by timing of season in accordance with site-specific characteristics.

Large, dead, and downed trees and standing snags are extremely important habitat components that should remain on the refuge unless they pose a danger to the public in concentrated use areas or to refuge operations. Unlikely incidents affecting hunters during general hunts would not be considered reason enough to remove snags. In some cases, the removal of trees along roads, trails, and dikes is necessary to reduce hazards to users caused by falling trees and limbs.

Impacts to refuge roads and trails due to soil compaction from vehicles, rutting, or root damage are possible, but can be avoided by restricting use to dry ground conditions. Traffic on refuge roads will need to be carefully controlled (via special use permit) to avoid impacts such as rutting and potholes. Because few requests are received for this type of activity, halting the practice entirely should not create a problem because local residents do not generally rely upon a supply of wood for home heating.

Firewood cutting benefits the public and can be used as a management tool in forested habitats and as a maintenance tool on roads, trails, and grounds. The removal of dead trees reduces litter buildup and the potential for damaging wildfires. Direct impacts on wildlife can be avoided by timing the activity so that it is not coincident with the breeding/production season. Individuals gathering firewood would be required to comply with special use permit conditions and site-specific stipulations to ensure that resources are protected and management goals are achieved.

Public Review and Comment: This compatibility determination is provided for public review and comment during the DraftComprehensive Conservation Plan comment period.
Determination:
____ Use is Not Compatible
_X_ Use is Compatible With Following Stipulations

Stipulations Necessary to Ensure Compatibility:

a. Firewood gathering would be regulated by Special Use Permit so that site-specific impacts can be reduced or eliminated and Service management goals are met. The permit would include stipulations that ensure the practice is allowed only when it benefits refuge operations or habitat conditions, areas and times of use are specified, ingress and egress points controlled, trees to be removed are marked by refuge staff, allowable equipment is identified, and other important conditions are specified.

b. The use would be restricted to periods of dry ground conditions to avoid rutting and soil compaction on refuge roads, to the extent practicable.

c. Firewood removed from refuge lands is for personal use only and may not be sold.

Justification: With the stipulations above, firewood gathering is in compliance with the Comprehensive Conservation Plan and furthers the goals and missions of the National Wildlife Refuge System and the Theodore Roosevelt National Wildlife Refuge Complex.

NEPA Compliance for Refuge Use Decision: *Place an X in appropriate space.*

___ Categorical Exclusion without Environmental Action Statement
___ Categorical Exclusion and Environmental Action Statement
_X_ Environmental Assessment and Finding of No Significant Impact
___ Environmental Impact Statement and Record of Decision

8. Fishing – including Frogging:

Refuge: Hillside, Mathews Brake, Morgan Brake, Panther Swamp, and Yazoo NWRs.

Description of Use: Recreational fishing (a wildlife-dependent activity) has been identified in the National Wildlife Refuge System Improvement Act of 1997 as a priority public use, provided it is compatible with the purpose for which the refuge was established.

Sport fishing and frogging in refuge waters are an integral part of the overall public use program in the Mississippi Delta. Several of the refuges in the complex have partnered with the state conservation department to install boat ramps. Refuges have constructed accessible piers, signs, and information kiosks to inform the public of the need for stewardship of public lands and waters and to increase the awareness of our natural resources.

Recreational fishing and frogging are common public uses in refuge waters on Hillside, Mathews Brake, Morgan Brake, and Panther Swamp NWRs, where fish populations support a sustainable harvest under a regulated fishing program. The refuge annual hunting and fishing permit is required to fish on the refuge. Fishing is conducted year-round from sunrise to sunset, subject to regulations established by the Mississippi Department of Wildlife, Fisheries, and Parks. Fish and Wildlife Service specific regulations further restrict fishing by prohibiting commercial fishing on the refuge, the use of certain fishing methods, and access after dark. Frogging is the only activity (except coon hunting) that is permitted after dark.

Several methods of fishing are employed, including boat fishing, wade fishing, and bank fishing. Boat and bank fishing are permitted, as provided by refuge special regulations and those published in Title 50, Code of Federal Regulations. Bank fishing will take place on areas with shallow slopes, mostly on existing footpaths or access trails. Frogging is conducted at night with gigs and by hand grabbing.

Coordination with the Service and State fisheries offices for monitoring fish populations, contaminants, and habitat conditions is handled by individual refuge managers. Yazoo NWR is closed to public fishing due to elevated levels of DDT and toxaphene in refuge waters. Should contaminant levels decline to an acceptable level in the future, Yazoo NWR's Steele Bayou may be opened to fishing, with restrictions. In addition, future plans on Yazoo NWR include a youth fishing area at Holt Collier Horseshoe Pond, for youth 15 years and younger when accompanied by an adult. The Holt Collier Horseshoe Pond is not connected to Steele Bayou where the contamination exceeds Federal limits, and it is anticipated that fishing in this area will be appropriate. Additional work is needed to develop the pond as a fishing area, including levee modification and fish stocking. Holt Collier and Theodore Roosevelt NWRs do not support fish populations sufficient to offer a sustainable harvest.

Availability of Resources: Annual refuge budget funds for operations and maintenance and fees collected under the refuge annual hunting and fishing permit have funded the cost of road and boat ramp maintenance. Funding has been marginally sufficient to properly maintain existing program levels. Additional funds and/or staff would be required to install additional boat ramps, fishing piers, and related fishing facilities.

Anticipated Impacts of the Use: Cooperation with state fisheries biologists in pond surveys and sampling helps to provide data for refuge management purposes. Littering and potential gasoline contamination in refuge waters may occur. Impacts are expected to be minor in nature. Wake damage has not been a serious problem in the past, as most motoring is necessarily slow due to the nature of the aquatic environment. Erosion and damage to vegetation due to foot traffic are expected to be minimal. Minor facility repair or rehabilitation would be completed when needed.

Public Review and Comment: This compatibility determination is provided for public review and comment during the DraftComprehensive Conservation Plan comment period.

Determination:

____ Use is Not Compatible
_X_ Use is Compatible with the following stipulations:

Stipulations Necessary to Ensure Compatibility: The following stipulations are required to ensure compatibility:

a. All sport fishing activities, including permitted methods of taking, limits, species and open/closed seasons, will be consistent with applicable state regulations. Enforcement efforts will be conducted by Fish and Wildlife Service's refuge law enforcement officers and agents from the Mississippi Department of Wildlife, Fisheries and Parks, when available.

b. Fishing is permitted from dawn to dusk. No fishing is allowed after dark.

c. Commercial fishing, or possession or use of jugs, seines, nets, had-grab baskets, or similar devices is prohibited.

d. Limits and size of boat motors for certain areas will be posted on refuge kiosks and informational boards, and published in Title 50, Code of Federal Regulations.

e. A public use General Permit is required to fish in refuge waters.

f. Camping, overnight use, and fires are prohibited.

Justification: The 1997 National Wildlife Refuge Improvement Act identified fishing as one of the priority public uses on national wildlife refuges, where compatible with refuge purposes. This use is legitimate and appropriate, and is dependent upon healthy fish populations. Use is in compliance with the Comprehensive Conservation Plan and furthers the goals and missions of the National Wildlife Refuge System and the Theodore Roosevelt National Wildlife Refuge Complex.

NEPA Compliance for Refuge Use Decision: *Place an X in appropriate space.*

___ Categorical Exclusion without Environmental Action Statement
___ Categorical Exclusion and Environmental Action Statement
_X_ Environmental Assessment and Finding of No Significant Impact
___ Environmental Impact Statement and Record of Decision

9. Hunting

Refuge: Hillside, Holt Collier, Mathews Brake, Morgan Brake, Panther Swamp, and Yazoo NWRs, and Farm Service Agency lands.

Recreational hunting (a wildlife-dependent activity) has been identified in the National Wildlife Refuge System Improvement Act of 1997 as a priority public use, provided it is compatible with the purpose for which the refuge was established. Recreational hunting is offered from October through April each year for deer, waterfowl, dove, quail, wild turkey, squirrel, rabbit, and raccoon. Hunters are also allowed to take feral hogs, raccoon, opossum, coyote, beaver, bobcat, and nutria during regular hunting seasons using the firearm permitted for that season.

Deer Hunting:

Deer consume agricultural crops planted as high calorie foods for wintering waterfowl and browse the understory vegetation in forested areas, preventing tree regeneration and altering the forest structure and species (flora and fauna) composition. Over-browsed habitat does not provide food or cover for scrub/shrub-dependent species, and bird habitat is damaged when deer consume the vegetation birds would use for cover or nesting. When deer herds reduce their food resources, they can starve or become susceptible to diseases that healthy deer do not contract under normal circumstances. A lack of sufficient food on refuge lands can promote migration of deer beyond refuge boundaries onto adjacent private lands where they can consume agricultural crops planted by refuge neighbors.

Allowing hunters to remove surplus deer reduces the potential for refuge habitat damage and agricultural crop losses, and negates the expense of controlling the deer herd with refuge employees. Regulation of season lengths, hunting areas, and hunter quotas ensures balance between population levels and carrying capacity.

Hunting for wild turkey, ducks, dove, quail, and small furbearers:

Hunting is also offered for wild turkey (on Panther Swamp NWR) waterfowl (on Panther Swamp, Hillside, Morgan Brake, and Mathews Brake NWRs) and small game animals from populations of animals capable of sustaining harvest, including rabbit, squirrel, raccoon, dove, and quail. Waterfowl hunting is offered in designated waterfowl hunt areas at designated times on Panther Swamp, Hillside, Morgan Brake, and Mathews Brake NWRs.

Squirrel and rabbit hunting (with and without dogs) is offered on specific refuges during designated seasons within the State season. Rabbits only may be hunted on the Carter Tract, Herron Tract, Brown Tract, and Holt Collier NWR. Raccoon and opossum hunting with dogs is allowed in designated areas during designated seasons on Yazoo, Panther Swamp, Morgan Brake, Mathews Brake, and Hillside NWRs.

Hunting Access

Vehicular access to hunting areas is limited by road conditions during hunting season. Without access, remote refuge areas would be under-harvested and the overall reduction of the deer herd would be insufficient to maintain the herd below carrying capacity. For these reasons, all- terrain vehicles (ATVs) are allowed on Panther Swamp, Morgan Brake, and Hillside NWRs as the primary means of deer hunter access via ATV trails. Yazoo NWR allows ATV-assisted deer retrieval only by permission on refuge roads and turn-rows not open to public vehicles.

Nuisance Animal Hunting:

Snow geese may be hunted by Special Use Permit as a means of reducing the population or discouraging the overabundant snow goose flocks from devastating feeding areas managed for other waterfowl. Hogs and furbearers may be taken by valid permit holders on any hunt except turkey and dove hunts with firearms legal for that hunt. Furbearers include raccoon, opossum, coyote, beaver, bobcat, and nutria. Raccoon may also be taken during any other hunt with firearms legal for that hunt.

Availability of Resources: The Complex's ability to offer recreational hunting is dependent upon an adequate infrastructure with three key components: (A) staff to administer a hunting program, (B) adequately maintained access roads and trails, and (C) an adequate number of law enforcement officers.

A. Adequate administrative staff: From mid-September to the end of February each year, a large percentage of the staff's time is devoted to managing the Complex's comprehensive hunt program. Each year the Complex issues approximately 7,800 permits; 2,000 limited special hunt permits for deer and wild turkey, and 5,800 permits for unlimited hunts. One full-time staff member devotes 100 percent of her normal tour of duty hours (plus an additional 15 hours per week during peak periods) to processing and issuing special use permits for general hunting, fishing, and quota hunt permits, and responding to about 2/3 of the thousands of telephone and visitor inquiries. She is assisted by one part-time staff member who works approximately 40 hours per week for 6 months greeting visitors, answering the telephone, entering data into the hunt program, and performing other visitor assistance duties. The assistant refuge managers on Panther Swamp and Morgan Brake NWRs, the Complex Biologist, Forester, and maintenance staff support the hunting program by answering telephones during busy times, greeting hunters, assisting hunters with directions or lost hunting gear, and operating deer check stations at Yazoo, Panther Swamp, and Hillside NWRs. The project leader and deputy assist with telephone and visitor assistance.

B. Adequately maintained roads and trails: Refuge staff devote a considerable amount of time to road maintenance (e.g., grading, mowing, and spraying), particularly on Panther Swamp NWR where local soils are not suitable substrate for roads. Interior roads constructed for farming or timber-harvest are often impassible to 2-wheel-drive vehicles and sometimes impassible to 4-wheel drive vehicles during wet weather. Since wet weather season coincides with hunting seasons, access is often one of the most expensive and time-consuming refuge maintenance tasks. Road maintenance consumes large amounts of fuel, chemicals, and time, and logs thousands of hours on refuge maintenance equipment. In some areas on a few refuges, particularly Panther Swamp NWR, road maintenance is possible only in late summer or early fall during the driest conditions.

The challenges associated with inadequate road maintenance and the resulting lack of public access by conventional vehicles to large portions of the refuges have been addressed somewhat by allowing the limited use of ATVs. Panther Swamp NWR currently offers 38 miles of ATV trails, Hillside NWR offers 9 miles, and Morgan Brake NWR offers 8 miles of trails, for a combined total of 55 miles. All trails are well defined on hunt brochure maps and are open only during periods of hunting and fishing. However, during the winter season and after rain events many ATV trails function as waterways, eroding soil along the way and increasing sedimentation in the forest and other types of habitats. Hunters on ATVs can get stuck in degraded ATV trails and veer off the trails through the forest. Excessive off-trail ATV use has a detrimental effect on habitat, including soil erosion, disruptions or diversions of water flow, the destruction of plant root systems, the spread of exotic and invasive plants, noise, and air pollution.

C. Adequate Numbers of Law Enforcement Officers: Complex law enforcement officers patrol and conduct surveillance, check hunter permits, assist with deer check stations, respond to hunter emergencies, enforce laws and regulations, ensure public safety, and protect refuge resources. The officers typically handle approximately 4,600 incidents or violations each year, including incidents associated with vandalism, suspicious person's reports, weapons violations, and natural resource violations. Refuge law enforcement officers also respond to additional requests for assistance to locate lost hunters, attend to hunting accidents, provide support for periodic flooding events that cover roads and trap hunters, and handle violations on refuge managed Farm Service Agency lands. During the 6-month-long hunting season, law enforcement officers devote 100 percent of their scheduled shifts to law enforcement plus an additional 20 hours of overtime per week during peak hunt periods to cover the refuges from 4 a.m. when hunters arrive, to 8 p.m., when most hunters have departed the refuge.

Anticipated Impacts of Use:

Impacts on Deer: Allowing hunters to remove surplus deer reduces the potential for habitat damage and agricultural crop losses, and negates the expense of controlling the deer herd with refuge employees. During normal reproductive years, the refuge's objective would be to annually remove approximately 33 percent of the deer population with a 1:1 harvest ratio of the sexes. The program is designed to optimize the number of deer taken, while maintaining a percentage of older bucks (5 to 10 percent) in the trophy class each year to attract enough hunters to reduce the herd by 33 percent. Regulation of season lengths, hunting areas, and hunter quotas ensure a balance between population levels and carrying capacity, while providing for public safety during hunting season.

Impacts on Habitat due to Access: ATV access allows hunters to hunt in areas that would otherwise be under-harvested, improving the overall herd reduction. ATVs serve to distribute hunters more evenly over the landscape, improving harvest results. Two executive orders regulate ATV use on federal public lands: Executive Order 11644, signed by President Nixon in 1972, and Executive Order 11989, signed by President Carter in 1977. Together these orders require that off-road-vehicle use on public lands must be managed to "protect the resources of those lands, to promote the safety of all users of those lands, and to minimize conflicts among the various uses of those lands." The orders also require that when ATV routes are designated, federal land managers must minimize damage to soils, watershed, vegetation, and other land resources, minimize wildlife harassment and impacts to wildlife habitat, and minimize conflicts between ATV use and other uses of the land. To comply with the orders, Service policy requires all ATV use to be in conjunction with wildlife-dependent activities only, with ATV use confined to designated areas or trails.

Impacts on Other Species: Hunting for ducks, wild turkey, and other game species is very popular, contributing considerably to the Complex's public use program. Turkey hunting produces little disturbance to waterfowl because the turkey hunting season is in the spring, after waterfowl have already migrated through the region. Hunting for squirrel, rabbit, raccoon, and opossum reduce excess numbers of these species which, without some type of harvest, would tend to experience population peaks and crashes. Hunting reduces fluctuations in the population and the incidence of disease and mortality in years of population surges. Duck hunting will disturb ducks, prompting their move to other areas, typically the waterfowl sanctuary area. Minor disturbance to other waterbirds may occur.

Impacts on Nuisance Animals: In compliance with the Fish and Wildlife Service's conservation order, hunters are allowed to take snow, blue, and Ross' geese during specific periods between October and March. Overpopulations have caused environmental damage to nesting grounds in the arctic and geese numbers have exceeded 250,000 at times on the refuges. Snow goose numbers will be reduced by the conservation order, although not substantially. Hunter presence will create enough disturbance to keep the flocks moving from one feeding area to another, and possibly move them off the refuge temporarily, leaving at least a portion of the food resources for other waterfowl. The taking of hogs and other furbearers in conjunction with other seasons will have little impact on hog and furbearer populations, as they are only occasionally taken.

Impacts on the public and refuge resources from unlawful acts: Law enforcement officers moderate conflicts between hunters that, without attention, could escalate into life-threatening situations. During hunting season, interactions between hunters, accidents, and conflicts are frequent. Deer hunting produces the greatest need for law enforcement presence as deer tend to congregate in relatively close proximity, and hunters gather in the same small areas to hunt. Thousands of firearm-carrying hunters converge each year in these choice hunting areas. Every year hunting equipment or gear is stolen, vehicles vandalized, and accidents occur. During deer-hunting season, an adequate law enforcement presence is needed to maintain the peace and safety of visitors and to prevent abuse of the wildlife resource. Limited draw hunts require a minimum of two and at times more law enforcement officers to adequately meet resource and public protection needs.

Unstaffed refuges (Holt Collier, Mathews Brake, Hillside NWRs) present law enforcement challenges because officers must provide coverage on all refuge lands during all peak deer hunting seasons. Hillside, Morgan Brake, and Mathews Brake are separated by a distance of approximately 25 miles. Panther Swamp NWR is separated from Hillside, Morgan Brake, and Mathews Brake by an hour's drive, and Yazoo NWR is separated from all the other refuges by at least an hour's drive. Adequate numbers of law enforcement officers are necessary to provide coverage from 4 a.m. to about 8 p.m., 7 days a week during the 6-month-long hunting season and to cover all hunting programs on all refuges concurrently.

Public Review and Comment: This compatibility determination is provided for public review and comment during the DraftComprehensive Conservation Plan comment period.

Determination:

____ Use is Not Compatible
_X_ Use is Compatible with the following stipulations:

a. Hunters must comply with relevant laws and all rules and regulations in the Theodore Roosevelt National Wildlife Refuge Complex hunting and fishing regulations.

b. Hunters may use ATVs for deer hunting only on Hillside, Morgan Brake, and Panther Swamp NWRs. Harvested deer must be dragged or carted to the ATV trail where they can be loaded onto an ATV. ATVs are not allowed off trails.

c. Adequate numbers of law enforcement staff are necessary to manage the hunts and to protect refuge resources and the public. The project leader may close any hunt at any time if he/she determines that there is an insufficient number of law enforcement officers to manage the hunts.

Justification: Hunting will be subject to the stipulations listed, and will not interfere with the primary purposes for which the refuge was established. With respect to white-tailed deer hunting, a deer harvest is essential to maintain desired bird habitat and wildlife health conditions. With stipulations, use is in compliance with the Comprehensive Conservation Plan and furthers the goals and missions of the National Wildlife Refuge System and the Theodore Roosevelt National Wildlife Refuge Complex.

NEPA Compliance for Refuge Use Decision: *Place an X in appropriate space.*

___ Categorical Exclusion without Environmental Action Statement
___ Categorical Exclusion and Environmental Action Statement
_X_ Environmental Assessment and Finding of No Significant Impact
___ Environmental Impact Statement and Record of Decision

10. Research

Refuge: Hillside, Holt Collier, Mathews Brake, Morgan Brake, Panther Swamp, Theodore Roosevelt, and Yazoo NWRs, and Farmers Home Administration Lands.

Description of Use: The Complex currently offers university professors and their students, partnering federal and state agencies, scientists, contractors, and others to conduct short- and long-term research projects, monitoring studies, and surveys on refuge lands. Research projects contribute to a better understanding of refuge wildlife and habitat resources, provide information to improve adaptive management decisions, and increase life history information on species of concern.

Research proposals on refuge lands are typically developed by research agencies, area universities, and colleges in coordination with the staff to support refuge special needs. Large-scale proposals are planned with input from the refuge. Other than staff time to review data and studies, research proposals and resultant studies are the responsibility and expense of the sponsoring school or group. The Complex supports research by authorizing housing for scientists while they are conducting their work, by periodic habitat manipulation (e.g., mowing and disking) and by research article review. Refuge funding maintains housing facilities. The Complex also provides secure sites for both short- and long-term studies, particularly in bottomland forest ecosystems of the Mississippi Alluvial Valley.

Research areas may be accessed by foot, vehicle, boat, or aerial methods. Marking of nests and individual animals may be required. The least invasive means required to accomplish objectives will be used.

Availability of Resources: Research and monitoring is funded by grants, other government agencies, universities, or by students and volunteers. Refuge staff involvement includes reviewing research proposals, supervising or monitoring research activities, reviewing reports, providing some equipment and vehicles, and occasionally participating in fieldwork. Staff time is devoted to research proposal/report development and/or review, Special Use Permit administration, student or volunteer supervision, and vehicle maintenance. The crew quarters and RVs at the Headquarters Office on Yazoo NWR, and the RVs at Morgan Brake and Panther Swamp are available to visiting researchers by special arrangement.

Research projects have primarily been initiated and funded by universities and other federal agencies (e.g., USDA Forest Service, U.S. Geological Survey, etc.). If extended housing is offered, the refuge may, at its discretion, require that the cost of utilities, maintenance, refurbishing, etc., be covered by the research unit. Other resources may be used, as acquired, through grants or other special funding.

Anticipated Impacts of the Use: Research projects would be evaluated by the Complex biologist and refuge manager to determine whether the project is aligned with information needs of the refuge and surrounding landscape. Only projects that benefit resource management would be approved.

Disturbance or removal of plants and wildlife could occur but is expected to produce only a temporary impact. Repopulation of the removed individuals would be expected to occur over time. Some temporary dispersal of animals around or off the refuge may occur from field activities. Special Use Permits or Cooperative Agreements would be developed to eliminate or minimize impacts to other uses and management activities.

Information collected from research projects will assist the refuge manager to fine-tune management activities, maximizing productivity of refuge lands. To ensure that studies have minimal impact on refuge species and habitats, research must meet the criteria in the refuge manual and the research outline/proposal must conform to Service guidelines. Only those studies that provide practical management data or can be used to further the science of wildlife management are approved. If approved, access to refuge lands and waters will be limited to the least invasive means required to accomplish the activities. Impacts on refuge purposes are all determined to be positive. Wildlife disturbance and impacts to refuge resources and infrastructure would be controlled through stipulations in a Special Use Permit issued to each user.

Public Review and Comment: This compatibility determination is provided for public review and comment during the DraftComprehensive Conservation Plan comment period.

Determination:
____ Use is Not Compatible
_X_ Use is Compatible with the Following Stipulations

Stipulations Necessary to Ensure Compatibility: The following stipulations are required to ensure compatibility:

a. Researchers would be required to obtain a Special Use Permit prior to conducting their research.

b. Studies proposed by outside agencies/institutions would be reviewed and approved by the refuge manager before access is authorized.

c. All proposals must conform to Service guidelines and be applicable to the management needs of the Complex.

Justification: Research will add to the base of knowledge in the field of wildlife management and will create no significant adverse affects on other refuge programs or wildlife populations.
Use is in compliance with the Refuge Comprehensive Conservation Plan and furthers the goals and missions of the National Wildlife Refuge System and the Theodore Roosevelt NWR Complex.

NEPA Compliance for Refuge Use Decision: *Place an X in appropriate space.*

___ Categorical Exclusion without Environmental Action Statement
___ Categorical Exclusion and Environmental Action Statement
_X_ Environmental Assessment and Finding of No Significant Impact
___ Environmental Impact Statement and Record of Decision

11. Timber Harvest for Forest Management

Refuge: Hillside, Holt Collier, Mathews Brake, Morgan Brake, Panther Swamp, and Theodore Roosevelt NWRs.

Description of Use: Timber harvest for forest management is currently conducted on Panther Swamp NWR in accordance with an approved Forest Management Plan that is designed to meet wildlife habitat objectives. The plan emphasizes activities that protect, restore, and manage the functions and values of the forest to support viable populations of native flora and fauna, consistent with sound biological principles. Priority is given to management activities for federal trust species such as migratory birds. Forest management prescriptions include timber stand improvement, commercial timber harvest, and reforestation. Habitat manipulations would be conducted primarily through commercial timber harvests of surplus forest products. The sale and disposition of forest products would comply with open market rules and formal bid solicitations.

Commercial timber harvest operations cannot be significantly expanded until a comprehensive forest inventory has been completed on Complex refuges, and a Forest Habitat Management Plan prepared. In the interim, the current Forest Management Plan for Panther Swamp Refuge will continue to be implemented.

Individual forest stands will be inventoried, timber harvest prescriptions developed, and timber harvest operations carried out in a manner that will accomplish the forest habitat management objectives for migratory birds, threatened or endangered species, and resident wildlife. Timber marking operations will select trees that would be harvested by commercial timber and pulpwood operators. Trees may also be removed through timber stand improvement operations or by permittees when commercial sales are not feasible.

Availability of Resources: Current funding and staffing allow only limited timber harvest activities on one refuge in the Complex (Panther Swamp NWR.) Additional funding and staffing would be required to expand timber harvest to the remaining refuges.

Anticipated Impacts of the Use: Commercial timber harvest operations can cause adverse impacts on habitat values and water quality if not carefully controlled and supervised. Restrictions and conditions must be placed on harvesting operations to minimize adverse effects from logging equipment, such as excessive defacement of residual trees and negative impacts on surface water quality. Minor short-term impacts are expected to occur during harvesting operations, including mechanized operation disturbance to wildlife and trampling of the understory vegetation by equipment. However, these impacts are short term as the understory vegetation usually recovers in one growing season.

Forest management operations are directed at providing more vertical diversity throughout the overstory, midstory, understory, and ground flora. Favoring trees of varying ages and sizes, including some of the largest dominants within each forest block, will promote the habitat requirements of forest-dwelling birds and other resident wildlife. Forest conditions following timber harvest are more beneficial to wildlife as harvest operations can help restore the functions and values typically associated with bottomland hardwood forests historically occurring throughout the region.

Public Review and Comment: This compatibility determination is provided for public review and comment during the DraftComprehensive Conservation Plan comment period.

Determination (check one below):

_____ Use is Not Compatible
_X_ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility: Forest management operations may be conducted throughout the year, but only according to the guidelines detailed in a Forest Management Plan and the special conditions section of the Special Use Permit. All harvesting would be conducted by Special Use Permit and carried out in accordance with the Refuge Manual.

Justification: The forest management actions proposed in the draft Comprehensive Conservation Plan are in accordance with Service guidelines for the protection, management and enhancement of habitats for wildlife populations on refuges. Adherence to a Forest Management Plan promotes the enhancement of habitats for threatened or endangered species, migratory birds and resident wildlife species; promotes habitat restoration; protects cultural resources; and provides opportunities for public recreation and environmental education. Use is in compliance with the Refuge Comprehensive Conservation Plan and furthers the goals and missions of the National Wildlife Refuge System and the Theodore Roosevelt National Wildlife Refuge Complex.

NEPA Compliance for Refuge Use Decision: *Place an X in appropriate space.*

___ Categorical Exclusion without Environmental Action Statement
___ Categorical Exclusion and Environmental Action Statement
_**X**_ Environmental Assessment and Finding of No Significant Impact
___ Environmental Impact Statement and Record of Decision

12. Trapping

Refuge: Hillside, Holt Collier, Mathews Brake, Morgan Brake, Panther Swamp, Theodore Roosevelt, and Yazoo NWRs, and Farm Service Agency lands.

Description of Use: Trapping is employed to prevent or reduce the loss of Federal trust species, prevent refuge habitat losses, and reduce habitat damage. The trapping program targets raccoon, coyote, bobcat, skunks, beaver, and nutria. Skunks and raccoons prey upon nests, often eating the eggs of wood ducks, wild turkey, and other birds. They also prey upon waterfowl and their young.

Population numbers of both species have increased on the refuge from the lack of hunting, trapping and natural predators. Nutria damage habitat and impair refuge infrastructure by rooting up vegetation and digging holes in levees or dikes, sometimes producing significant damage. Beavers cause a considerable amount of damage to refuge infrastructure by burrowing into levees and dikes, plugging water control structures and pipes, destroying timber and crops in agricultural fields, and flooding or undermining roads and bridges. There are few natural predators to keep the population in check, thus beavers can quickly overpopulate an area.

Cooperative partnerships with commercial trappers have helped reduce populations of beaver, raccoon, nutria, and bobcat. The trappers spend 2-3 weeks at each refuge during the state trapping season. In exchange for refuge housing in RVs at Morgan, Panther Swamp, and Yazoo NWR, they trap the above-identified animals and are permitted to retain the furs for later commercial purposes. Trappers use pick-ups, vehicles, and ATVs to access trapping sites on the refuge. They are permitted on refuge roads and interior trails during the time they are trapping. In the 2004 trapping season, 4 trappers spent approximately 700 hours trapping for beaver, nutria, and raccoon on Yazoo, Panther Swamp, and Morgan Brake NWRs.

Availability of Resources: Because the Complex lacks sufficient staff to administer the trapping program, the cooperative partnership with visiting trappers benefits refuge resources. Staffing and funding are available to administer the trapping program at the current level. Existing RVs at refuge offices are offered for trappers' use during the period they are trapping.

Anticipated Impacts of the Use: Beaver trappers using the refuge in the winter may cause temporary displacement of waterfowl from specific and limited areas. In the early spring they may disturb waterfowl or wood ducks on occasion. These impacts would be occasional, temporary, and isolated to small geographic areas. There have been no reported conflicts between hunters and trappers. To avoid contact with other refuge users, traps will not be set in the hunting areas during open seasons. The permit system offers the refuge manager the opportunity to specifically target nuisance species and regulate techniques and methods for their removal.

Controlling populations of animals that prey on waterfowl or damage refuge habitat has positive impacts on waterfowl populations and refuge resources. Raccoon prey upon waterfowl at various stages in the production cycle, and beavers build dams that flood and kill forest habitat. The capture of animals, such as otters, will occur to some extent during beaver trapping, but trappers are advised to avoid trapping non-target species. Visiting trappers minimize the need to commit Service resources to a trapping program, and produce positive impacts for waterfowl and other aquatic wildlife species. Reducing beaver populations helps to reduce damage to forest habitat and damage to levees and dike infrastructure on the refuge from beaver burrowing. Likewise, an over-abundance of nutria can lead to an excessive loss in emergent vegetation.

Public Review and Comment: This compatibility determination is provided for public review and comment during the DraftComprehensive Conservation Plan comment period.

Determination:
____ Use is Not Compatible
_X_ Use is Compatible, with the Following Stipulations

Stipulations Necessary to Ensure Compatibility:

a. Trapping is conducted in compliance with a Special Use Permit.

b. Trapping will not be allowed in hunting areas during open season or in high-visibility public use areas.

c. Take of non-targeted animals will be minimized by trap set and locations.

d. A trapping report will be required of the individual named in the Special Use Permit.

e. All traps must be flagged and checked daily.

Justification: Trapping is a valuable management tool that is used to prevent predation of Federal trust species and reduce damage to refuge habitat and infrastructure. With the above stipulations, little or no adverse effects to other refuge programs or wildlife species will occur. Use is in compliance with the comprehensive conservation plan and furthers the goals and missions of the National Wildlife Refuge System and the Theodore Roosevelt National Wildlife Refuge Complex.

NEPA Compliance for Refuge Use Decision: *Place an X in appropriate space.*

___ Categorical Exclusion without Environmental Action Statement
___ Categorical Exclusion and Environmental Action Statement
_X_ Environmental Assessment and Finding of No Significant Impact
___ Environmental Impact Statement and Record of Decision

Approval of Compatibility Determinations:

Signature: _____
Project Leader Date

Review: _____
Regional Compatibility Coordinator Date

Review: _____
Refuge Supervisor Date

Concurrence: _____
Regional Chief Date

Mandatory 10- or 15-Year Re-evaluation Date: **2015 - 2020**

APPENDIX VI. PRIORITY BIRD SPECIES AND SPECIES SUITES

BCR 26 priority species (B=Breeding, N=Non-breeding, T=transient, PB=Post-breeding; FE=Federally Endangered, FT=Federally Threatened, SL=listed in at least one State within BCR)

<u>Tier I.</u> SPECIES OF HIGH CONTINENTAL AND/OR REGIONAL CONCERN (Regional Combined Score presented only for Tier I species, except waterfowl)

<u>Immediate Management</u>
25 Ivory-billed Woodpecker (B, N) (extirpated?) also SL
25 Bachman's Warbler (B) (extirpated?) also FE, SL

22 Buff-breasted Sandpiper (T) (USSCP Cat.=5)

21 Henslow's Sparrow (N) also SL

20 Greater Prairie-Chicken (B, N) (extirpated)
20 Prothonotary Warbler (B)
20 Swainson's Warbler (B) also SL

19 American Woodcock (N) (USSCP Cat.=4)
19 Cerulean Warbler (B) (21 T) also SL

18 Swallow-tailed Kite (B) also SL
18 King Rail (B) also SL
18 "Western" Painted Bunting (B)

16 Wood Thrush (B)

Northern Pintail (N)

<u>Management Attention</u>
21 Golden-winged Warbler (T)

20 Blue-winged Warbler (T)

19 Black Rail (T) also SL
19 Yellow Rail (N)
19 Bay-breasted Warbler (T)
19 Canada Warbler (T)

18 American Bittern (N)
18 Mississippi Kite (B) also SL
18 Hudsonian Godwit (T) (USSCP Cat.=4)
18 Semipalmated Sandpiper (T) (USSCP Cat.=3)
18 Wilson's Phalarope (T) (USSCP Cat.=4)

18 Rusty Blackbird (N)
18 Orchard Oriole (B)

17 American White Pelican (N)
17 Yellow-crowned Night-Heron (B) also SL
17 Wood Stork (N) also SL
17 American Golden-Plover (T) (USSCP Cat.=4)
17 American Avocet (T) (USSCP Cat.=3)
17 Upland Sandpiper (T) (USSCP Cat.=4)
17 Least Sandpiper (N) (USSCP Cat.=3)
17 Stilt Sandpiper (T) (USSCP Cat.=3)
17 Short-billed Dowitcher (T) (USSCP Cat.=4)
17 Black Tern (T)
17 Red-headed Woodpecker (B, N)
17 Mourning Warbler (T)

16 Northern Bobwhite (B, N)
16 Horned Grebe (N)
16 Little Blue Heron (B) also SL
16 White Ibis (N)
16 Northern Harrier (N)
16 Solitary Sandpiper (T) (USSCP Cat.=4)
16 Western Sandpiper (T) (USSCP Cat.=4)
16 Least Tern (B) (20 Interior subspecies) also FE, SL
16 Short-eared Owl (N)
16 Olive-sided Flycatcher (T)
16 Northern Parula (B)

15 Tricolored Heron (B)
15 Lesser Yellowlegs (T) (USSCP Cat.=3)
15 Sanderling (T) (USSCP Cat.=4)
15 Dunlin (T) (USSCP Cat.=3)
15 Common Tern (T)
15 Black Skimmer (B)
15 Yellow-billed Cuckoo (B)
15 Loggerhead Shrike (B, N) also SL
15 White-eyed Vireo (B, N)
15 Yellow-breasted Chat (B)
15 Field Sparrow (N)
15 Grasshopper Sparrow (N)
15 Eastern Meadowlark (B, N)
15 Baltimore Oriole (B)

14 Pied-billed Grebe (B only) also SL
14 Least Bittern (B) also SL
14 Purple Gallinule (B)
14 Northern Flicker (B, N)
14 Eastern Wood-Pewee (B)
14 Eastern Kingbird (B)
14 Brown Thrasher (B, N)
14 Vesper Sparrow (N)

14 Savannah Sparrow (N)
14 Dickcissel (B)

Mallard (N)
American Black Duck (N)
Canvasback (N)
Lesser Scaup (N)

Planning and Responsibility
18 Worm-eating Warbler (T)

16 Wilson's Snipe (N) (USSCP Cat.=3)
16 Willow Flycatcher (T)

15 Willet (T) (USSCP Cat.=3)
15 Kentucky Warbler (B)

14 Prairie Warbler (B)

Mottled Duck (B, N)

Tier II. SPECIES NOT OTHERWISE OF CONTINENTAL NOR REGIONAL CONCERN WHERE MONITORING (i.e., All Planning and Responsibility) ATTENTION IS NEEDED TO ENSURE POPULATION STABILITY

Planning and Responsibility
Wood Duck (B, N)
Killdeer (B, N)
Pectoral Sandpiper (T) (USSCP Cat.=2)
Red-bellied Woodpecker (B, N)
Yellow-bellied Flycatcher (T)
Alder Flycatcher (T)
Least Flycatcher (T)
Philadelphia Vireo (T)
Sedge Wren (N)
Tennessee Warbler (T)
Blackburnian Warbler (T)
Le Conte's Sparrow (N)

Tier III. SPECIES WHERE AT LEAST MONITORING ATTENTION IS NEEDED TO ENSURE POPULATION PERSISTENCE (i.e., All at least Planning and Responsibility), BUT MANAGEMENT ATTENTION MAY OR MAY NOT BE NECESSARY BASED ON LEGAL REQUIREMENTS AND POLITICAL BOUNDARIES

Tier III a. Additional Federally Listed

Bald Eagle (B, N) FT, also SL
Piping Plover (N) FT, also SL (USSCP Cat.=5)

Red-cockaded Woodpecker (B, N) FE, also SL

Tier III b. Additional State Listed

Trumpeter Swan (N) KY
Blue-winged Teal (B) KY
Northern Shoveler (B) KY
Hooded Merganser (B) KY
Double-crested Cormorant (B) KY
Anhinga (B) TN
Great Blue Heron (B) KY
Great Egret (B) KY, TN
Snowy Egret (B) IL, KY, MO, TN
Cattle Egret (B) KY
Black-crowned Night-Heron (B) IL, KY, TN
Osprey (B) IL, KY
Northern Harrier (B) IL, KY, MO, TN
Peregrine Falcon (B, T) IL, LA, KY, MO, TN
Common Moorhen (B) IL, KY, TN
American Coot (B only) KY
Barn Owl (B, N) IL, KY, MO, TN
Bell's Vireo (B) IL, KY
Bank Swallow (B) KY
Fish Crow (B) KY
Bewick's Wren (N) IL, KY, MS, TN
Sedge Wren (B) KY
Brown Creeper (B) KY
Lark Sparrow (B) KY, TN

Tier III c. Additional politically recognized species (e.g., natureserve s1, s2)

[REFER TO EACH STATE'S NATURAL HERITAGE DATABASE; MANY SPECIES ABOVE ARE LIKELY INCLUDED IN MANY OF THE DATABASES WITHIN THE STATES THEY OCCUR IN]

Tier IV. OTHER SPECIES OF CONSERVATION OR MANAGEMENT INTEREST, NOT OTHERWISE LISTED ABOVE (LOCAL OR REGIONAL INTEREST=LORI species; some species may be listed in more than one sub-tier below)

Tier IV a. Locally Rare or Peripheral Species of Interest (e.g., certain nonbreeding hummingbird species found in the Southeast U.S., Continental Concern species with RD=1)

Common Loon (T)
Neotropical Cormorant (B)
Double-crested Cormorant (B)
Glossy Ibis (B, N)
White-faced Ibis (B, N)
Roseate Spoonbill (B, N)
Sandhill Crane (T)
Black-necked Stilt (B) (USSCP Cat.=3)

Whimbrel (T) (USSCP Cat.=4)
Marbled Godwit (T) (USSCP Cat.=4)
Ruddy Turnstone (T) (USSCP Cat.=4)
Red Knot (T) (USSCP Cat.=4)
Gull-billed Tern (B)
Willow Flycatcher (B)
Western Kingbird (B)
Scissor-tailed Flycatcher (B)
Warbling Vireo (B)
Brown-headed Nuthatch (B, N)?
Black-and-white Warbler (B)
American Redstart (B)
Worm-eating Warbler (B)
Bachman's Sparrow (B)?

Tier IV b. Game Species of Particular Local or State Management or Economic Interest (e.g., Wild Turkey, many species of waterfowl)

Snow Goose (Lesser subspecies, mid-continent population)
Canada Goose (Mississippi Valley population)
Green-winged Teal (N)
Blue-winged Teal (N)
Northern Shoveler (N)
Gadwall (N)
American Wigeon (N)
Ring-necked Duck (N)
Greater Scaup (N)
Wild Turkey (B, N)
Virginia Rail (N)
Sora (N)
American Coot (N)
Mourning Dove (B, N)

Tier IV c. Nongame Species of Particular Local or State Management or Economic Interest (e.g., Ruby-throated Hummingbird, Purple Martin, Eastern Bluebird)

Green Heron (B)
Red-shouldered Hawk (B, N)
White-rumped Sandpiper (T) (USSCP Cat.=2)
Baird's Sandpiper (T) (USSCP Cat.=2)
Long-billed Dowitcher (N) (USSCP Cat.=2)
Bonaparte's Gull (N)
Forster's Tern (T)
Common Nighthawk (B)
Ruby-throated Hummingbird (B)
Pileated Woodpecker (B, N)
Carolina Chickadee (B, N)
Indigo Bunting

<u>Tier IV d.</u> Species frequently occurring as a regional concern species in other BCRs, just not in this one, with RD>2 (good to keep track of species where they are doing well, when in many BCR's they are not doing well)

Chuck-will's-widow (B)
Chimney Swift (B)
Acadian Flycatcher (B)
Yellow-throated Vireo (B)
Yellow-throated Warbler (B)
Hooded Warbler (B)
Summer Tanager (B)

<u>Tier IV e.</u> Species Important as Environmental Indicators (e.g., many species of raptors, such as Osprey, and herons, such as Great Blue Heron)

<u>Tier IV f.</u> Nuisance or Depredating Species (e.g., crows, grackles, cowbirds, most blackbirds, double-crested cormorants)

<u>Local or Regional Population Control/Suppression</u>
American White Pelican (non-breeding populations associated with aquacultural facilities)

Double-crested Cormorant (non-breeding populations associated with aquacultural facilities)

Great Blue Heron (associated with aquacultural facilities)
Great Egret (associated with aquacultural facilities)
Snowy Egret (associated with aquacultural facilities)
Little Blue Heron (associated with aquacultural facilities)
Tricolored Heron (associated with aquacultural facilities)

Cattle Egret (associated with colonies causing potential health and safety problems, potential competion and replacement of higher priority colonial nesters [e.g., Little Blue Heron]

<u>Tier IV g.</u> Continental Stewardship Species high RD>3 or TB=1

***Action Level:**

IM=Immediate management needed to reverse or stabilize significant, long-term population declines in species with small populations, or to protect species with the smallest populations for which trends are poorly known. Lack of action may lead to extirpations or extinction. Generally species with a TB/TN=5 or a TB/TN=4+PT=5 fall under this action level.

MA=Management or other on-the-ground conservation actions needed to reverse or stabilize significant, long-term population declines in species that are still relatively abundant. All other Regional Concern species that are not IM, fall under this action level. Some Federally or State/Provincial listed species not otherwise meeting either Continental or Regional Concern criteria may fall under this action level.

PR=Long-term Planning and Responsibility needed for species to ensure that sustainable populations are maintained for species for which a region has high responsibility for that species. All Continental Concern species that are not also Regional Concern species fall under this action level, as well as any additional Regional Stewardship and Continental Stewardship species and any additional LORI species identified.

PC = Population Control/Suppression needed for species that are otherwise secure and increasing that may come into conflict with other species of higher conservation concern or other resources of interest.

PCL = Local or Regional Population Control/Suppression that generally are species listed as in need of Management Attention or Long-term Planning and Responsibility, but locally may be subject to population control measures to alleviate documented economic, environmental, or human health and safety conflicts, but only when economics and conservation implications have been thoroughly considered.

Priority Bird-(General) Habitat Relationships for Southeastern Coastal Plain (BCR 26), Southeast U.S. Species may occur in more than one habitat (only major habitats are recognized here). Species are considered permanent resident within a habitat (though there may be major seasonal movements within the BCR) unless otherwise noted as B=breeding resident, N=non-breeding resident, T=transient. Regional Combined Score is used to rank Tier I species (except waterfowl) within a habitat, within an Action Level (IM=Immediate Management, MA=Management Attention, PR=Planning and Responsibility, PCL= Local or Regional population control/suppression, defined at end of table; ext.?=likely extirpated or nearly so). Neartic-Neotropical migrants are identified by an asterisk (*).

Conservation Tier/Action Level;	**Open mature pine**	**Mature Hardwood, forested wetlands, pine-hardwood mix**	**Shrub-scrub**	**Grassland, open lands**	**Woodland transients**	**Marshes/long-legged waders**	**Open water near –shore, inland**	**Mudflats, shallow flooded ag**	**River sandbars**	**Off-shore (pelagic)**
Tier I High Concern IM		Ivory-billed Woodpecker (25; ext?)	American Woodcock (N, 19)	Buff-breasted Sandpiper* (T, 22)	Cerulean Warbler* (T, 21)	King Rail (B, 18)	Northern Pintail (N)			
		Bachman's Warbler* (B, 25; ext.?)	"Western" Painted Bunting * (B, 18)	Henslow's Sparrow (N, 21)						
		Prothonotary Warbler * (B, 20)		Greater Prairie-Chicken (20; ext.)						
		Swainson's Warbler * (B, 20)								
		American Woodcock (N, 19)								
		Cerulean Warbler* (B, 16)								
		Swallow-tailed Kite * (B, 18)								
		Wood Thrush * (B, 16)								

Conservation Tier/Action Level;	Open mature pine	Mature Hardwood, forested wetlands, pine-hardwood mix	Shrub-scrub	Grassland, open lands	Woodland transients	Marshes/long-legged waders	Open water near –shore, inland	Mudflats, shallow flooded ag	River sandbars	Off-shore (pelagic)
Tier I High Concern MA		Mississippi Kite * (B, 18)	Orchard Oriole * (B, 18)	American Golden-Plover * (T, 17)	Golden-winged Warbler * (T, 21)	Yellow Rail (T, 19)	American White Pelican (N, 17)	Hudsonian Godwit * (T, 18)	Black Tern * (T, 17)	
		Rusty Blackbird (N, 18)	White-eyed Vireo * (15)	Upland Sandpiper * (T, 17)	Blue-winged Warbler * (T, 20)	Black Rail (T, 19)	Horned Grebe (N, 16)	Semipalmated Sandpiper * (T, 18)	Least Tern * (B, 16)	
		Red-headed Woodpecker (17)	Yellow-breasted Chat * (B, 15)	Northern Bobwhite (16)	Bay-breasted Warbler * (T, 19)	American Bittern (N, 18)	Mallard (N)	Wilson's Phalarope * (T, 18)	Common Tern * (T, 15)	
		Solitary Sandpiper * (T, 16)	Brown Thrasher (14)	Northern Harrier (N, 16)	Canada Warbler * (T, 19)	Yellow-crowned Night-Heron (B, 17)	American Black Duck (N)	American Avocet (T, 17)	Black Skimmer (B, 15)	
		Northern Parula * (B, 16)		Short-eared Owl (N, 16)	Mourning Warbler * (T, 17)	Wood Stork (N, 17)	Canvasback (N)	Least Sandpiper (N, 17)		
		Yellow-billed Cuckoo * (B, 15)		Loggerhead Shrike (15)	Olive-sided Flycatcher * (T, 16)	Little Blue Heron (B, 16)	Lesser Scaup (N)	Stilt Sandpiper * (T, 17)		
		Baltimore Oriole (B, 15)		Field Sparrow (N, 15)		White Ibis (N, 16)		Short-billed Dowitcher (T, 17)		
		Northern Flicker (14)		Grasshopper Sparrow (N, 15)		Tricolored Heron (B, 15)		Black Tern * (T, 17)		
		Eastern Wood-Pewee * (B, 14)		Eastern Meadowlark (15)		Pied-billed Grebe (B, 14)		Solitary Sandpiper * (T, 16)		
				Eastern Kingbird * (B, 14)		Least Bittern * (B, 14)		Western Sandpiper (T, 16)		

Conservation Tier/Action Level;	Open mature pine	Mature Hardwood, forested wetlands, pine-hardwood mix	Shrub-scrub	Grassland, open lands	Woodland transients	Marshes/long-legged waders	Open water near –shore, inland	Mudflats, shallow flooded ag	River sandbars	Off-shore (pelagic)
				Vesper Sparrow (N, 14)		Purple Gallinule * (B, 14)		Lesser Yellowlegs * (T, 15)		
				Savannah Sparrow (N, 14)				Sanderling * (T, 15)		
				Dickcissel * (B, 14)				Dunlin (T, 15)		
								Common Tern * (T, 15)		
I. High Concern PR		Kentucky Warbler * (B, 15)	Prairie Warbler * (B, 14)	Smith's Longspur (N, 18)	Worm-eating Warbler * (T, 18)	Wilson's Snipe (N, 16)	Mottled Duck	Willet (T, 15)		
					Willow Flycatcher * (T, 16)					
Tier II Additional Stewardship PR		Wood Duck (B)		Killdeer	Yellow-bellied Flycatcher (T)		Wood Duck	Pectoral Sandpiper* (T)		
		Red-bellied Woodpecker		Sedge Wren (N)	Alder Flycatcher (T)					
				Le Conte's Sparrow (N)	Least Flycatcher (T)					
					Philadelphia Vireo (T)					
					Tennessee Warbler (T)					
					Blackb urnian Warbler (T)					

Conservation Tier/Action Level;	Open mature pine	Mature Hardwood, forested wetlands, pine-hardwood mix	Shrub-scrub	Grassland, open lands	Woodland transients	Marshes/long-legged waders	Open water near –shore, inland	Mudflats, shallow flooded ag	River sandbars	Off-shore (pelagic)
III Additional Fed Listed	Red-cockaded Woodpecker (AR only)	Bald Eagle						Piping Plover (N)		
III Additional State Listed		Hooded Merganser (B)	Bell's Vireo (B)	Cattle Egret (B)		Great Blue Heron (B)	Trumpeter Swan (N)	Peregrine Falcon * (T)		
		Peregrine Falcon * (B)	Bewick's Wren (N)	Northern Harrier (B)		Great Egret (B)	Blue-winged Teal (B)			
		Brown Creeper (B)		Pererine Falcon * (T)		Snowy Egret (B)	Northern Shoveler (B)			
				Barn Owl		Black-crowned Night-Heron (B)	Hooded Merganser (B)			
				Sedge Wren (B)		Common Moorhen (B)	Double-crested Cormorant (B)			
				Lark Sparrow (B)		American Coot (B)	Anhinga (B)			
							Osprey * (B)			
							Peregrine Falcon * (T)			
							Bank Swallow * (B)			
							Fish Crow (B)			
IV Other Local or Regional Interest PR	Wild Turkey	Red-shouldered Hawk	Willow Flycatcher (B)	Sandhill Crane (T)		Green Heron (B)	Snow Goose (N)	Black-necked Stilt (B)	Gull-billed Tern (B)	
	Chuck-will's-widow (B)	Wild Turkey	Warbling Vireo (B)	Western Kingbird (B)		Glossy Ibis	Canada Goose (N)	Whimbrel (T)		

Conservation Tier/Action Level;	Open mature pine	Mature Hardwood, forested wetlands, pine-hardwood mix	Shrub-scrub	Grassland, open lands	Woodland transients	Marshes/long-legged waders	Open water near –shore, inland	Mudflats, shallow flooded ag	River sandbars	Off-shore (pelagic)
	Pileated Woodpecker	Mourning Dove		Scissor-tailed Flycatcher (B)		White-faced Ibis	Green-winged Teal (N)	Marbled Godwit (T)		
	Carolina Chickadee	Chimney Swift (B)		Common Nighthawk (B)		Roseate Spoonbill	Blue-winged Teal (N)	Ruddy Turnstone (T)		
	Brown-headed Nuthatch (?)	Ruby-throated Hummingbird (B)				Virginia Rail (N)	Northern Shoveler (N)	Red Knot (T)		
	Bachman's Sparrow (B?)	Pileated Woodpecker				Sora (N)	Gadwall (N)	White-rumped Sandpiper (T)		
		Acadian Flycatcher (B)				American Coot (N)	American Wigeon (N)	Baird's Sandpiper (T)		
		Yellow-throated Vireo (B)					Ring-necked Duck (N)	Long-billed Dowitcher (N)		
		Carolina Chickadee					Greater Scaup (N)			
		Yellow-throated Warbler (B)					Common Loon (T)			
		Black-and-white Warbler (B)					Neotropical Cormorant (B)			
		American Redstart (B)					Double-crested Cormorant (B)			
		Worm-eating Warbler (B)					Bonaparte's Gull (N)			

Conservation Tier/Action Level;	Open mature pine	Mature Hardwood, forested wetlands, pine-hardwood mix	Shrub-scrub	Grassland, open lands	Woodland transients	Marshes/long-legged waders	Open water near –shore, inland	Mudflats, shallow flooded ag	River sandbars	Off-shore (pelagic)
		Hooded Warbler (B					Forster's Tern (N)			
		Summer Tanager (B)								
		Indigo Bunting (B)								
Tier IV Other Local and Regional Interest PCL				Cattle Egret (B)		Great Blue Heron (N)	American White Pelican (N)			
						Great Egret (N)	Double-crested Cormorant (N)			
						Snowy Egret (N)				
						Little Blue Heron (N)				
						Tricolored Heron (N)				

*Nearctic-Neotropical Migrant species, those species with populations principally breeding in temperate North American areas that winter principally in tropical North American and/or South America areas.

Action Level:

IM=Immediate management needed to reverse or stabilize significant, long-term population declines in species with small populations, or to protect species with the smallest populations for which trends are poorly known. Lack of action may lead to extirpations or extinction. Generally species with a TB/TN=5 or a TB/TN=4+PT=5 fall under this action level.

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PCL = Local or Regional Population Control/Suppression that generally are species listed as in need of Management Attention or Long-term Planning and Responsibility, but locally may be subject to population control measures to alleviate documented economic, environmental, or human health and safety conflicts, but only when economics and conservation implications have been thoroughly considered.

APPENDIX VII. BUDGET REQUESTS

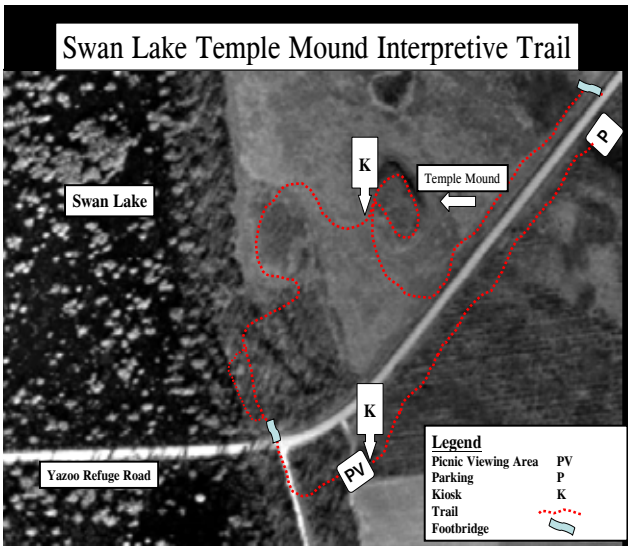
Project Name	Amount
1. On Morgan Brake NWR divert a gravel road 200 feet away from the North Hill Ponds spring, and restore a 200-foot zone surrounding the spring by planting native shrubs.	$11,000
2. Construct an informational kiosk at Live Oak Mound, Yazoo NWR.	$22,000
3. Improve public access to information by developing and maintaining up-to-date websites for the Complex and each individual refuge. (This project would require the installation of a new satellite system at Morgan Brake and Panther Swamp NWRs to replace the antiquated telephone dial-up system now in use.)	$30,000
4. Construct a Visitor's Center and Headquarters Facility for TR NWR Complex.	$3,500,000
5. Control beaver populations to ensure that no more than 5% of bottomland hardwoods are converted to aquatic sites.	$40,000
6. Provide and protect habitat for endangered and threatened species on Complex lands (i.e., interior least tern, bald eagle, pallid sturgeon, pondberry, and Louisiana black bear).	$35,000
7. Provide a minimum of 4,500 acres of moist soil/shallow water habitat for waterfowl to support national and regional plans.	$400,000
8. Provide a minimum of 435 acres of shallow water habitat for fall shorebird migration.	$30,000
9. Provide habitat to support a minimum of five colonial waterbird rookeries on Complex lands.	$10,000
10. Provide brood habitat and nest sites to support 3,000 hatchling wood ducks each year on Complex lands.	$65,000
11. Maintain a population of at least 700 alligators, and protect habitats for turtles, snakes, lizards, and crocodilians on Complex lands.	$15,000
12. Maintain existing habitat and breeding sites to support resident amphibians on Complex lands.	$15,000
13. Maintain and/or enhance a minimum of 2,000 acres of deepwater aquatic habitat for viable fishery.	$20,000
14. Provide agricultural grains for waterfowl and other wildlife	$200,000
15. Manage a minimum of 42,000 acres of mature forest for native resident and migratory species.	$370,000

Project Name	Amount
16. Provide and maintain a minimum of 1,500 acres of scrub/shrub habitats for ground-nesting birds and migratory songbirds.	$70,000
17. Maintain existing and provide a minimum of 500 acres of new habitat for grasslands species	$40,000
18. Eradicate or control non-native or native invasive species, pest species, and nuisance animals.	$450,000 - $550,000
19. Expand Complex's research and monitoring program to ensure that management decisions continue to be based upon sound science.	$800,000 - $900,000
20. Provide technical and financial assistance for habitat restoration to private landowners and non-governmental conservation organizations through the Partners for Fish and Wildlife Program and the Mississippi Partners Program	$190,000
21. Emphasize partnership efforts in the Conservation Partners Focus Area to restore habitat, place lands under conservation easements from willing participants, enroll land in the USDA Farm Bill conservation programs, or offer land for reforestation under the carbon sequestration initiative.	$180,000
22. Develop the Swan Lake Temple Mound Trail and Interpretive Site at Yazoo NWR.	$90,000
23. Enhance hunting and fishing programs	$330,000-$380,000
24. Construct Bear Paw Self Guided Nature Trail, an extension of the Holt Collier Trail at Yazoo NWR.	$65,000
25. Improve existing roads to develop the Theodore Roosevelt Wildlife Drive, Yazoo NWR.	$550,000
26. Carbon Sequestration Forest Demonstration Area, Yazoo NWR.	$25,000
27. Develop the infrastructure for Anhinga Swamp Canoe Trail & Rookery Lookout Platform at Yazoo NWR.	$88,000
28. Plan and construct Yankee Run, a self guided Nature Trail at Yazoo NWR.	$39,000
29. Construct the Beargarden Lake Trail and Lookout at Yazoo NWR.	$80,000
30. Construct the Alligator Alley Environmental Education Kiosk at Yazoo NWR.	$45,000
31. Develop Morgan Brake Bluff Trail on Morgan Brake NWR.	$100,000
32. Develop Auto Wildlife Tour on Morgan Brake NWR.	$290,000

Project Name	Amount
33. Develop Panther Creek Wildlife Drive on Panther Swamp NWR.	$450,000
34. Develop Panther Swamp NWR Observation Tower in Lower Twist.	$80,000
35. Develop observation tower at Morgan Brake NWR.	$57,000
36. Provide adequate protection for refuge resources, Federal trust species, personnel, and the visiting public.	$650,000-$800,000
37. Meet current and expand the ability to meet growing maintenance needs.	$250,000
38. Improve fire suppression and prescribed burning capabilities	$15,000
Total (does not include routine vehicle and equipment replacement)	**$9,697,000-$10,097,000**

Appendix VIII. Examples Of Proposed Public Use Facilities At Yazoo Nwr

Swan Lake Mounds Interpretive Exhibit and Trails
Yazoo NWR
Theodore Roosevelt NWR Complex



Infrastructure Required:

- Remove cane and black locust saplings, mow mound and interpretive areas.
- Improve existing parking areas.
- Construct footbridge across roadside ditch to mound side of road.
- Construct loop interpretive trail from parking areas to summit of Temple Mound, across prehistoric plaza to adjacent disturbed mounds along Swan Lake, to viewing/rest area, and back to parking area.
- Convert existing western parking area to viewing/resting area with benches and public restroom (vault type).
- Develop and construct two interpretive Kiosks, 1 at Temple Mound, 1 at viewing/rest area with trail maps, site interpretation, and other visitor information.
- Outreach to make public aware of resources: Highway Road Signs on Hwy 1 and 61. Refuge Website page with website links to NPS Indian Mounds of MS, links to other tourism sites, brochures, fact sheets, pamphlets.

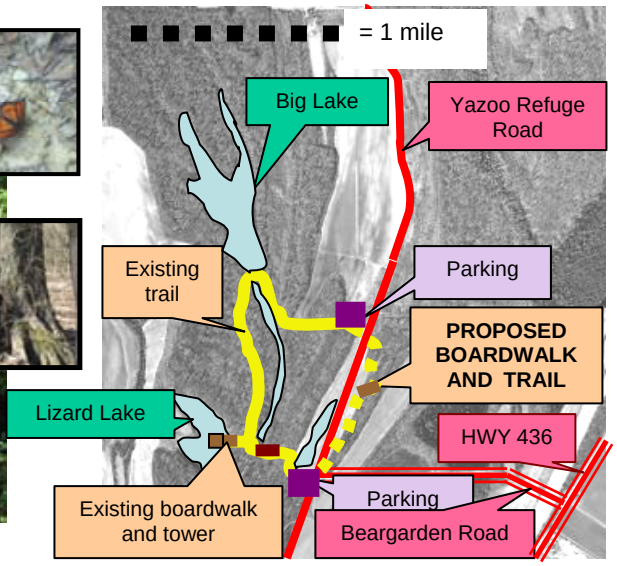
Estimated Cost to Deliver: $70,000 - 80,000 initial, with recurring annual costs of $10,000

Personnel Needed to Deliver: Complex Outdoor Recreation Planner, Park Ranger (interpretive)

Private Sector Support Needed: Hotel/Motel Rooms in local area. Local Restaurants, Cafes

Bearpaw Self-Guided Nature Trail
Yazoo NWR
Theodore Roosevelt NWR Complex

Self-Guided Nature Trail



Conceptual sketch of project

Infrastructure required:

- Add ¾ mile to existing hiking trail to complete loop.
- 50' of boardwalk across forested wetland.
- Directional trail signs and interpretive markers.
- Trail brochure for interpretation of selected natural and historical features.

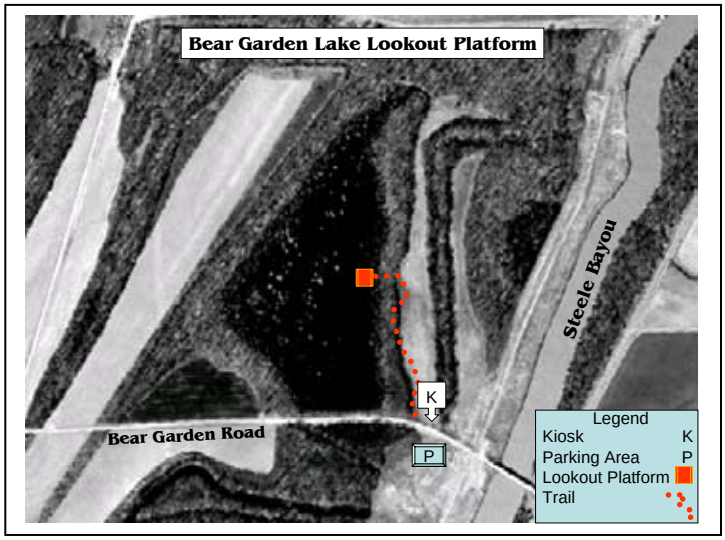
Estimated cost to deliver: $50,000, with recurring annual costs of $15,000

Personnel needed to deliver: Complex Public Use FTE, existing maintenance staff

Private sector support needed: Nearby restaurants, fueling stations, convenience stores (existing)

Outreach: Advertise on refuge website, kiosks on refuge roads

Bear Garden Lake Lookout Platform
Yazoo NWR
Theodore Roosevelt NWR Complex



Infrastructure Required:

- Create parking area in conjunction with horseshoe pond parking area located south of Bear Garden Road.
- Erect informational kiosk along toe of road bed leading to trail.with site information and other interpretive material, ie. floral and faunal species potentially observed.
- Construct boardwalk and trail to lookout platform.
- Construct platform
- Construct a limited number of benches and/or tables for resting while on platform.
- Provide covering for shaded viewing and photography opportunities.
- Outreach to make public aware of resources: Highway Road Signs on Hwy 1 and 61. Refuge Website, other tourism sites, brochures, fact sheets, pamphlets.

Estimated Cost to Deliver: $70,000.00 initial, with recurring annual costs of $10,000

Personnel Needed to Deliver: Complex Public Use FTE, existing maintenance staff

Private Sector Support Needed: Motels, Bed & Breakfasts in local area (existing)
Restaurants in local area (existing)

Hunt Central
Yazoo NWR Visitor Resource Station
Theodore Roosevelt NWR Complex

Existing Kiosk

New Kiosk

Infrastructure Required:

- Replace existing kiosk at Complex headquarters with new structure.
- Relocate existing Hunter Information Station
- Construct concrete foundation for kiosk and walkway around kiosk.
- Construct new 6-panel kiosk that faces the southwest with easily accessible panels for changing information.
- Informational panels:
    - Detailed map (poster size) of Yazoo NWR.
    - Hunt regulations, harvest stats and photos.
    - Recreation opportunities offered on Yazoo NWR (i.e. trails and tower, photography, wildlife observation, champion tree, etc.).
    - Theodore Roosevelt Complex info and other interpretive material. (Large location map with major highways noted in background with site locations brought forward).
    - Brochure pockets on each panel with related brochures (bird, mammal, herp, etc. lists) and info for that panel.

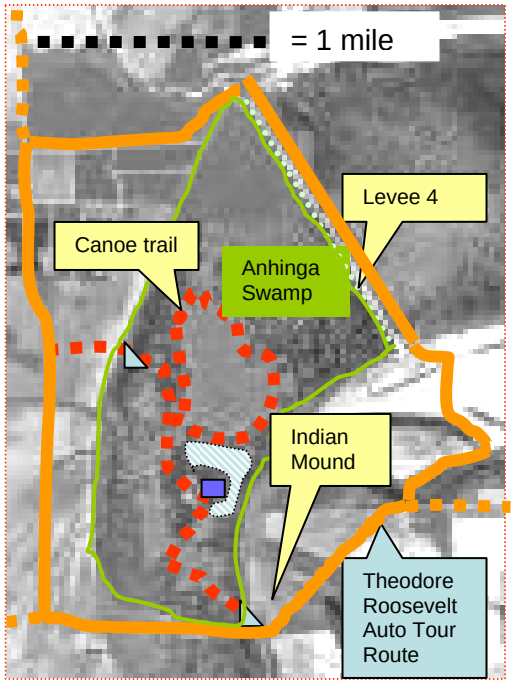
Estimated Cost to Deliver: $40,000 initial, with recurring annual costs of $2,000

Personnel Needed to Deliver: Complex Public Use FTE, existing maintenance staff

Private Sector Support Needed: Motel facilities, restaurants, fueling stations, convenience stores in local area (existing).

Theodore Roosevelt Wildlife Drive
Yazoo NWR
Theodore Roosevelt NWR Complex

View of Anhinga Swamp



Conceptual sketch of project

Infrastructure required:

- Improve 1.5 miles of road across Levee 4 with clay/gravel base.
- Construct an auto crossing at the Levee 4 spillway.
- Mark and maintain 12 interpretive stops along the route (supported by an interpretive brochure), plus directional signs.
- Produce an interpretive brochure to be dispensed at the Indian Mound Kiosk (proposed).
- Install an automatic gate at the Cox Pond intersection

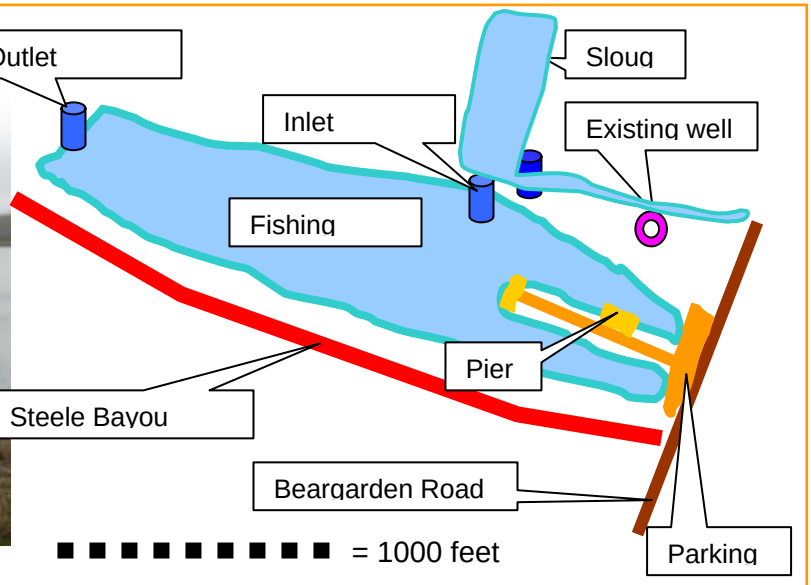
Estimated cost to deliver: $**500,000 initial costs with recurring annual costs of $50,000**

Personnel needed to deliver: Complex Outdoor Recreation Planner, Park Ranger (interpretive)

Private sector support needed: Fuel/Gas Stations

Outreach: Website coverage, links to tourism sites, dedication ceremony with news media coverage.

Holt Collier Horseshoe Pond
Youth Fishing Area
Yazoo NWR
Theodore Roosevelt NWR Complex



Holt Collier Horseshoe *Pond Conceptual Sketch of Project*

Infrastructure Required:

- 10 acre pond (existing), 10' deep.
- Inlet WCS—Filtered inlet from slough to prevent entry of rough fish.
- WCS for drainage.
- Well for maintaining water level (existing).
- 3' flashboard riser WCS in Hoot's Dump Slough overflow.
- 6' x 20' accessible fishing platform at end and side of spur levee.
- Parking area with wheelchair accessible surface to fishing platform(s).
- Informational sign at parking area. 4' x 4'
- Litter barrel at site.

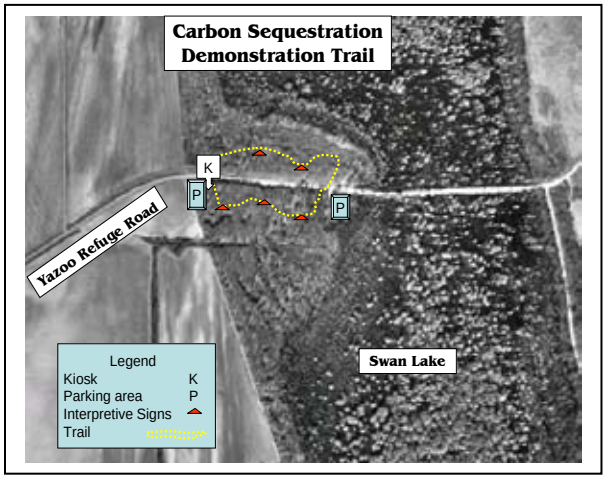
Estimated cost to deliver: $250,000-300,000 initial, with recurring annual costs of $80,000

Personnel needed to deliver: Complex Public Use FTE, existing maintenance staff, existing Biologist

Private sector support needed: Nearby bait shops, convenience stores, fueling stations, restaurants (all existing)

Outreach: Dedication ceremony with newspaper coverage. Brochures, website.

Carbon Sequestration Demonstration Trail
Yazoo NWR
Theodore Roosevelt NWR Complex



Infrastructure Required:

- Bushhog area along the south side of Yazoo Refuge Road (west of Long Dump Road.)
- Improve Parking areas at each end of 1968 reforestation area.
- Construct loop interpretive trail through reforestation area with strategically located stations discussing carbon sequestration, wildlife habitat, thinning treatments, etc.
- Establish descriptive signs at interpretive stations to allow for self-guided tours.
- Place signs along trails identifying planted tree species and naturally invading species.
- Extend trail loop north of the road to illustrate difference between thinned and non-thinned area.
- Construct informational Kiosk at trailhead with pockets for trail maps, site info. and other interpretive materials
- Outreach to public: Highway Road Signs on Hwy 1 and 61. Refuge Website, other tourism sites, brochures, fact sheets, pamphlets.

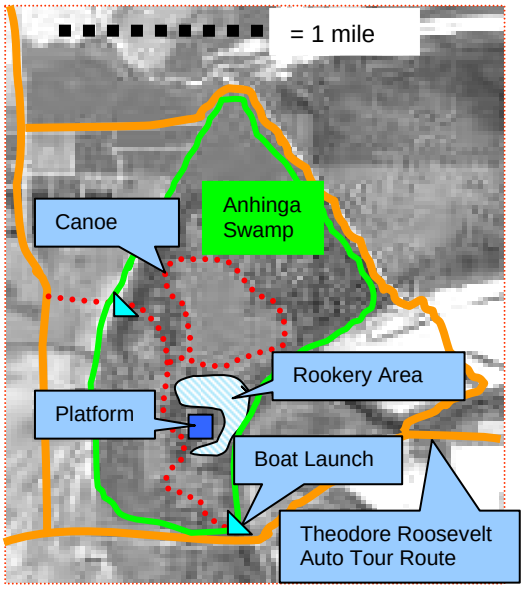
Estimated Cost to Deliver: ***$20,000 initial, with recurring annual costs of $5,000***

Personnel Needed to Deliver: Complex Public Use FTE, existing Forester, existing maintenance staff

Private Sector Support Needed: Motels, Bed & Breakfasts in local area (existing) Restaurants in local area (existing), Canoe Rentals at Lake Washington (existing)

Anhinga Swamp Canoe Trail and Rookery Observation Platform
Yazoo NWR
Theodore Roosevelt NWR Complex

Rookery inhabitants



Conceptual Sketch of Project

Infrastructure Required:

- Clear and mark a boat trail through cypress swamp.
- Create a boat launch area and parking lot (location to be determined).
- Improve access to boat launch area.
- Construct a 20' x 20' platform in the swamp for viewing the wading bird rookery.
- Produce an interpretive brochure and map. Use Indian Mound kiosk to dispense brochures.

Estimated Cost to Deliver: $80,000 initial, with recurring annual costs of $8,000

Personnel Needed to Deliver: Complex Public Use FTE

Private Sector Support Needed:

Motels, Bed & Breakfasts, restaurants, canoe rentals nearby (all existing).

Alligator Alley Environmental Education
Wildlife Viewing Area
Yazoo NWR
Theodore Roosevelt NWR Complex

Infrastructure Required:

- Develop and construct informational kiosk at Alligator Alley, a pond near the Headquarters Office that provides wildlife viewing of several resident alligators
- Provide brochures with educational information about alligator reproduction, preferred foods, life span, habitat requirements, and other informative info
- Improve existing road and construct parking area
- Outreach to make public aware of resources: Highway Road Signs on Hwy 1 and 61. Refuge Website page with website links to other tourism sites, fact sheets, pamphlets.

Estimated Cost to Deliver: $10,000, with annual recurring costs of $1,000

Personnel Needed to Deliver: Outdoor Recreation Planner FTE

Private Sector Support Needed: Website links, Hotel/Motel Rooms in local area,.Local Restaurants, Cafes

Theodore Roosevelt National Wildlife Refuge Complex
Hillside, Mathews Brake, Morgan Brake, Panther Swamp,
and Yazoo National Wildlife Refuges

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Hollandale, MS 38748
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U.S. Fish & Wildlife Service
1 800/344 WILD
http://www.fws.gov

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